# IP•Tube

## DLT1/DLE1
## GT1/GE1
## RS530DL/HS
## RS232/X.21/V.35
## SER
## T3/E3
## UNO
## G4

# User's Guide

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Revision 11

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Engage Communication Service Center:
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# Chapter 1

## Introduction

The IP•Tube User's Guide provides the information users require to install and operate the IP•Tube family of products developed and manufactured by Engage Communication, Inc. The use of Engage IP•Tube systems requires one IP•Tube at each end of an IP connection. Cable connections and the setting of configuration variables are needed to install the IP•Tubes.

### IP•Tube Family

The IP•Tube DLT1/DLE1 models encapsulate from one to two full and fractional T1 or E1 and TDM circuits, along with their framing and signaling bits, into IP packets.

The IP•Tube GT1/GE1 models encapsulate from one to four full and fractional T1 or E1 and TDM circuits, along with their framing and signaling bits, into IP packets.

The IP•Tube T3 model encapsulate from one full T3 circuit, along with its framing and signaling bits, into IP packets.

The IP•Tube's TDM Over IP connection provides for the transparent interconnection of PBXs, ACD's and other Telecom switches and T1, E1 or T3 based communication systems via LANs, WANs, MANs, and Wireless Ethernet interconnects.

The IP•Tube RS530/LS/HS, IP•Tube RS232 and IP•Tube V35/LS/HS models encapsulate synchronous serial data from Data Terminal Equipment (DTE) or Data Communication Equipment (DCE) such as Encryptors, Terminal Servers, Video Codecs, and WAN Routers into IP packets. The IP connection provides for a transparent interconnection of DTEs and DCEs via LANs, WANs, MANs, Satellite and Wireless Ethernet. The size and frequency of the IP packets can be controlled, yielding efficient data rates ranging from 2.4 Kbits/sec to 16 Mbits/sec.

Some models of the IP•Tube may include features such as Compression and Echo Cancellation (ECAN). Features can be utilized to make the data stream more secure, (ADP), produce trouble-shooting information, (SNMP Traps), provide redundant connections, (Protector and Switch options), and other advantages.

The following IP•Tube models are equipped with built-in data compression:

- IP•Tube DLT1•C
- IP•Tube DLE1•C
- IP•Tube GT1•C
- IP•Tube GE1•C

This lossless data compression can greatly reduce bandwidth usage over the IP connection, particularly during periods of idle traffic, yielding reductions in bandwidth utilization as great as 56 to 1.

The compression ratio is based upon the frames per packet setting of the IP•Tube's T1/E1 interface. The available compression ratios for each of the models is as follows:

- IP•Tube DLT1•C -8:1 to 56:1
- IP•Tube DLE1•C - 8:1 to 40:1
- IP•Tube GT1•C - 8:1 to 56:1

- IP•Tube GE1•C - 8:1 to 40:1

For interoperability with the IP•Tube DLT1•C and IP•Tube DLE1•C models, the IP•Tube GT1•C and GE1•C models must match the frames per packet settings of the models to which they are being connected.

Note: Round trip delays in excess of 20 milliseconds may require echo cancellation, if the systems do not have integrated echo cancellation or the links are digital end to end. The amount of delay can be calculated based on the **TUBE FPP** and the **TUBE BUFFERS** settings. The IP•Tube DLT1/E1-Ecan and GT1/E1-Ecan are versions with an integrated Echo Cancellation option. **Note:** Echo Cancellation is not field upgradable, must be ordered at time of purchase.

## LAN Interface

The IP•Tube DLT1/GT1/DLE1/GE1/RS530LS/RS530HS/RS232/V.35LS/V.35HS models feature two 10/100BaseT full/half duplex Ethernet interfaces for connection to IP interconnects.

The IP•Tube UNO model feature a single 10/100BaseT full/half duplex Ethernet interfaces for connection to IP interconnects.

The IP•Tube G4 model featuture a 10/100BaseT full/half duplex Ethernet switch. There are five Ethernet ports available (ETH1-ETH5). Four of which are connected together as a switch (LAN1 = ETH1, ETH3-ETH5). The remaining port is seperate (LAN2 = ETH2).

## WAN Interface

T1 interfaces offer an integrated T1/fractional T1 DSU/CSU for direct connection to dedicated or frame relay services at speeds up to 1.544 Mbps.

E1 interfaces offer an integrated E1/fractional E1 DSU/CSU for direct connection to dedicated or frame relay services at speeds up to 2.048 Mbps.

RS-530 models have a synchronous serial interface for interconnection to routers, encryptors, video codecs, etc. via a DB25 connector.

RS-232 models have a synchronous serial interface for interconnection to routers, encryptors, video codecs, etc. via a DB25 connector.

V.35 models have a synchronous serial interface for interconnection to routers, encryptors, video codecs, etc. via a DB25 connector.

## About this Guide

### Organization

Chapter 1 - *Introduction* provides an overview of the IP•Tube User's Guide.

Chapter 2 - *QuickStart* provides concise configuration examples to get the experienced user up and running in a minimum amount of time.

Chapter 3 - *Installation* covers the physical environment and connections required when installing the

IP•Tube. It also includes explanations of the Status LED's and descriptions of the ADP, Protector and Switch features.

Chapter 4 - *Configuration Examples* is a collection of the more common configurations for various models and feature sets. These samples can be cut and pasted into the user interface as a shortcut in the configuration of IP•Tube units.

Chapter 5 - *Command Line Reference* provides a command-by-command description of the Engage CLI.

Chapter 6 - *DLT1/E1 GT1/E1 UNO G4 Configuration and Operation* discusses the initial configuration and ongoing operation of the IP•Tube DLT1/E1, GT1/E1, UNO and G4 models. A discussion on bandwidth and data rate issues is included.

*Chapter 7: IP•Tube RS530DL/RS530HS/RS232/X.21/V35/ and IP•Tube SER RS530/RS232/V35 Configuration and Operation* discusses the initial configuration and ongoing operation of the IP•Tube models with RS-530, RS232 or V.35 synchronous serial interfaces. A discussion on bandwidth and data rate issues is included.

Chapter 8 - *IP•Tube SER RS530 AutoProtect* discusses parameters associated with the IP•Tube SER RS530 Auto Protect Feature

Chapter 9 - *T3 Configuration and Operation* discusses the initial configuration and ongoing operation of the IP•Tube models with T3 synchronous serial interfaces.

Chapter 10 - *E3 Configuration and Operation* discusses the initial configuration and ongoing operation of the IP•Tube models with E3 synchronous serial interfaces.

Chapter 11 - *Troubleshooting* the most common issues occurring during installation and normal operation.

*Appendices* - IP•Tube specifications, connector pinouts and crossover wiring details.

*Glossary* - routers, networks, telecommunication and TCP/IP terminology.

## Intended Audience

This manual is intended for experienced system administrators. The technical content is written for those who have basic computer, telecommunication and networking experience.

It is important that any administrator responsible for the installation and operation of Engage IP•Tube products be familiar with IP networking and data communication concepts, such as network addressing and synchronous serial interfaces. These concepts are central to an understanding of IP•Tube functionality. Several of the most common terms and concepts are covered in the Glossary section.

# Chapter 2

# Installation QuickStart

This *QuickStart* Chapter is intended for users who understand how they want their IP•Tube installed and configured and only require the mechanics of performing the installation. It includes the basic configuration of the units and has some detail on the more complex clocking aspects of the RS530, RS232 and V35 models. Refer to Chapter 4: *Configuration Examples* for cut and paste configuration.

## Communication with the IP•Tube

### Console Port

Initial communication with the IP•Tube is made through the Console port, utilizing the Command Line interface detailed in Chapter 5: *Command Line Interface*. Communication to the Console port should be set as:

**9600 baud, 1 stop bit, no parity, 8 bit data, flow control none**

The Console port on the IP•Tube utilizes an RJ45 jack. The Console port is configured as a DTE port. An RJ45/DB9 adapter is provided with the IP•Tube which permits a direct connection to DCE equipment, such as a COM connection of a PC.

Once a serial connection between a workstation and the IP•Tube Console port is established and a carriage return **<CR>** is entered, a **Login** prompt will appear.

The default login is: **root**.

No password is needed until it is set by the user, with the command **Passwd**.

### Telnet

Once an IP address has been assigned to the IP•Tube Ethernet interface, the user can telnet into the IP•Tube from anywhere on the local network and continue configuration using the Command Line Interface.

### Editing & Pasting Configurations

Users of the Command Line Interface, (CLI), have the option of editing standard IP•Tube configurations in a text editor and pasting that configuration to the IP•Tube. The examples in Chapter 4: *Configuration Examples* can be used as templates and include a variety of the most common configurations.

Edit the desired configuration listing using a simple text editor then connect to the IP•Tube through Telnet or the Console port and enter the configuration mode with the command: **config.**

Paste the edited text, comments and all, to the IP•Tube then issue the command: **save**. The IP•Tube will reset and come up with the new configuration.

To save an IP•Tube configuration, issue the command: **show configuration all** and save the response listing to a text file.

## IP Tube Cabling

The IP•Tube DLT1/DLE1 and the GT1/GE1 models use standard 10/100BaseT Ethernet cabling to connect to an Ethernet switch or hub. A crossover 10/100BaseT cable can be used for direct connection to a single router, wireless radio or other Ethernet device.

The cabling used to connect the IP•Tube T1/E1 Port to the T1/E1 interface to be extended depends upon whether it is connecting to T1/E1 equipment (PBX, Phone System, Multiplexor) or directly to a T1/E1 line.

In the case of a connection to the T1/E1 interface of T1/E1 equipment, a crossover cable is required. The IP•TubeT1/E1 is shipped with a T1/E1 Crossover Cable that uses yellow cabling. Refer to the *Appendices* for the details of the wiring of this cable. Connections to T1/E1 lines are made with a standard, straight-through T1/E1 cable.

# IP•Tube Configuration Parameters

The setup of the IP•Tube involves configuration of the following:

- IP•Tube System Parameters
- IP•Tube Data Conversion Parameters
- Interface Specific parameters

Examples are provided in Chapter 4: *Configuration Examples* and a complete description of all commands is available in Chapter 5: *Command Line Interface*.

## IP•Tube System Parameters

System parameters include the IP•Tube Hostname, the Ethernet IP address and the default router.

Examples:

**Host Name AptosTube**

Note: Provide a unique name for the IP•Tube.

**Ethernet IP address**

**IP ADDRESS aaa.bbb.ccc.ddd/ee**

The IP address is applied on a per-interface basis.

**Ethernet Broadcast Reception**

The Ethernet interface can be configured to disable the reception of Broadcast and Multicast packets. The IP protocol uses broadcast packets to resolve the Ethernet MAC Address of the destination IP. If BroadcastRCV is set to **Off** the Tube Ether ARP and Tube Ethernet Address need to be configured with the MAC address.

**BroadcastRCV {ON | OFF}**

Note: The Destination IP•Tube or the Default Router and any local device that wants to communicate with the IP•Tube needs to be configured with the MAC address of the IP•Tube in its ARP table. Due to the complexity involved in setting up the IP Address to Ethernet MAC address manually it is recommended that BroadcastRCV be set to **On,** unless broadcast storms are expected on the network where the IP•Tubes reside.

**IP•Tube Default-Router**

If the Remote IP•Tube, whose IP address is configured with **TUBE ADDRESS**, resides on a different IP network from the Local IP•Tube, a default router must be specified. The Default Router is typically the local IP WAN Router.

**IP DEFAULT-ROUTER aaa.bbb.ccc.ddd**

## IP•Tube Data Conversion Parameters

The IP•Tube has enable/disable commands as well as control of Protocol, Framing Encapsulation, Tube Destination Address, Destination UDP Port, IP Type of Service (TOS), Buffers, Frames per Packet, (FPP), and Compression, (optional).

These parameters are manipulated within the Serial Interface Configuration(s).

**Protocol**

The interface protocol controls the packetization format of the IP•Tube. The options are IPTUBE, CESoIP and HDLCoIP.

IPTUBE Protocol encapsulates the data bits selected into UDP packets.

CESoIP Protocol encapsulates the data bits selected into UDP packets with an RTP header.

HDLCoIP Protocol encapsulates HDLC frames into UDP packets with an RTP header. This protocol is used to interconnect data networks that utilize WAN protocols such as PPP, Frame Relay, HDLC and SDLC.

**Type**

The interface type LAN1/E1/T1/RS530/V35 is defined by the IP•Tube model purchased. Do not change the Interface Type as it is hardware dependent.

**IP•Tube Enable**

The IP•Tube is enabled by the command **TUBE ON**.

**IP•Tube Framing**

The IP•Tube parameter, **TUBE FRAMING**, is set to either: Transparent or T1/E1 Framed. Transparent framing encapsulates the DS0 data without the T1/E1 framing information. T1Framed encapsulates the T1 framing bits along with the DS0 data. E1Framed encapsulates the E1 framing byte along with the DS0 data.

A DS0 is a 64 Kbps Voice/Data circuit. T1 frames have 24 DS0s and a framing bit for a total of 193 bits per frame. E1 frames have 31 DS0s and a Framing/Signaling Byte for a total of 32 bytes per frame.

Note: Tube Framing only applies to DLT1/E1 or GT1/E1 IP•Tubes. Using a Loopback plug with T1/E1 Framed is not a valid test configuration.

**IP•Tube Destination Address**

**TUBE ADDRESS aaa.bbb.ccc.ddd**

Specifies the IP address of the receiving IP•Tube.

Note: Loopback of the IP•Tube data occurs when the Destination Address is the same as the IP address of the Ethernet interface.

**IP•Tube Destination UDP Port**

**TUBE UDPPORT nnnn**

Specifies the UDP port source and destination address. The IP•Tube only accepts packets that match

its UDP Port configuration.

Note: Engage has registered with the IANA UDP, port 3175 decimal, (reference www.iana.org/assignments/port-numbers). For the IP•Tubes DLT1/E1 and GT1/GE1 use the following UDP port numbers depending on which ports are activated:

- Port 1 UDP port 3175
- Port 2 UDP port 3176
- Port 3 UDP port 3177
- Port 4 UDP port 3178

**IP•Tube IP Packet Type of Service**

The TUBE TOS command is used to set the Type of Service byte in the IP packets encapsulated in the T1/E1 frames. The setting of the TOS byte can be used to ensure that the real time TDM data from the IP•Tube is ensured high priority. The Quality of Service support is required within each router or switch within the interconnect between the IP•Tubes. A TOS setting of 0x08 "maximizes throughput".

**TUBE TOS 0x08**

An alternative to the use of the TOS byte is the configuration for QoS based on UDP port number. Engage has registered UDP port assignment 3175. QoS configuration to prioritize UDP packets destined for port 3175 can be setup.

**Note:** It is possible to set the Differentiated Services Code Point (DSCP) field using the TOS value. The Differentiated Services (DiffServ) uses the same byte in the IP Header as the TOS. The 6 MSB of the TOS byte are the same bits used for setting the DSCP value. To enter the Expedited Forwarding (EF) DSCP value enter the following hex value in the TOS field: **0xB8**. This will mark these packets as EF.

Communication between IP•Tube systems uses packets destined for a configurable UDP port number. The IP•Tube defaults to UDP port 3175.

**IP•Tube Buffers**

**TUBE BUFFERS nn**

As IP/UDP packets are received at the IP•Tube Ethernet interface, they are buffered prior to the enabling of the T1/E1 transmitter. This provides for elasticity. The **TUBE BUFFERS** setting permits the user to configure the number of packets buffered - with valid settings from 3 to 85.

A large value provides greater elasticity but can introduce significant delay. The amount of delay can be calculated from the T1/E1 data rate, the **TUBE FPP** setting, (below), and the **TUBE BUFFERS** setting. See Chapter 5: *IP•Tube Configuration and Operation* for an analysis of how IP•Tube settings contribute to the overall round trip delay or latency.

Note: Round trip delays in excess of 20 milliseconds may require Echo Cancellation. ECAN is not field upgradeable.

**IP•Tube Frames Per Packet**

**TUBE FPP nn**

Specifies the number of frames received on the T1/E1/RS530/V35 interface to be encapsulated in a single IP/UDP packet. The size of the serial interface frame depends on the interface provided to the IP•Tube:

- T1 frame size is 192 bits + 1 framing bit, (depends on T1Framing config)
- E1 frame size is 256 bits
- RS530/V.35 frame size is 512 bits (64 bytes)

Low latency applications, such as voice, require minimum Frames Per Packet. The recommended configuration for low latency for T1 is FPP = 8, for E1 it's FPP = 12.

**IP•Tube Compression**

**TUBE COMPRESSION ON**

Enables compression on IP•Tube C models.

**IP•Tube Ethernet ARP**

**TUBE Ethernet ARP OFF**

**U**ses the Ethernet MAC address specified by the TUBE Ethernet Address setting.

**TUBE Ethernet ARP ON**

Uses the Ethernet MAC address obtained automatically by the IP•Tube's IP to Ethernet MAC Address Resolution Protocol, (ARP).

Note: Unless Broadcast storms are expected it is highly recommended that the automatic resolution of the IP address to Ethernet MAC address is utilized by setting **TUBE Ethernet ARP On,** (**ARP On** is the Default).

**IP•Tube Ethernet Address**

**TUBE ETHERNET ADDRESS aabbccddeeff**

Allows the user to specify the Ethernet MAC address for the IP•Tube IP packet. The TUBE Ethernet MAC Address needs to match the MAC address of the destination IP•Tube or the Default Router.

## Interface Specific Parameters

**T1 Configuration Parameters**

The IP•Tube T1 serial interface number 1, (S1), is configured for T1 operation at the factory. The following T1 parameters must match the configuration of the DS1/T1 interface to which it is connected. The T1 clock setting is dependent upon the source of the T1 Clock.

**Interface S1**
Type T1
T1 Data {Normal | Invert}
T1 Clocking {Internal | Network | V2PLL | PLL | GPS | OCXO | GPSBackupOCXO}
T1 LBO CSU {0dB | -7.5 | -15 | -22.5}
T1 Framing {ESF | D4}
T1 Coding {B8ZS | AMI}
T1 IdleCharacter value
T1 Channels {Full | Fractional: Starting DS0 - Number of DS0s}

Note: When more then one group of non contigous channels is needed, hyphens and commas can be used to list all group, or individual channels.

Note: T1 Clocking GPS, OCXO and GPSBackupOCXO is only available for the IP•Tube G4 as an upgradable options at time of purchase.

Example:

**T1 Channels Fractional 1-4, 8-12, 16 8**

This configuration of the usage of a fractional T1, will enable channels 1,2,3 and 4, 8,9,10,11 and 12, 16,17,18,19,20,21,22,23, and 24.

**E1 Configuration Parameters**

The IP•Tube E1 serial interface number 1, (S1), is configured for E1 operation by the manufacturer. The following E1 parameters must match the configuration of the E1 interface to which it is connected. The E1 clock setting is dependent upon the source of the E1 Clock.

**Interface S1**
Type E1
E1 Data {Normal | Invert}
E1 Clocking {Internal | Network | V2PLL | PLL | GPS | OCXO | GPSBackupOCXO}
E1 Framing {CRC4 | FAS | UNFRAMED}
E1 Coding {HDB3 | AMI}
E1 IdleCharacter value
E1 Channels {Full | Fractional: Starting DS0 - Number of DS0s}

Note: When more then one group or individual, non contigous channels are needed, hyphens and commas can be used to list all groups and individual channels.

Note: E1 Clocking GPS, OCXO and GPSBackupOCXO is only available for the IP•Tube G4 as an upgradable options at time of purchase.

Note: Improper configuration of T1/E1 clocking will result in an overrun or underrun condition which causes periodic frame losses. One of the IP•Tubes must be the master clock source or locked onto a master and the remote end unit uses a Phase Lock Loop, (PLL) or Version2 Phase Lock Loop (V2PLL), circuit to match the master's T1 clock frequency. In the case where an IP•Tube is being connected to a T1 line from the Telephone company, the IP•Tube connected to the Telco T1 line must be set to **T1 Clocking Network** and the remote unit set to **T1 Clocking V2PLL**.

**RS-530/V.35 Configuration Parameters**

The configuration parameters for the IP•Tube RS-530 and the IP•Tube V.35 models differ slightly from those for IP•Tube DLT1/E1 and GT1/E1 models. **TUBE FRAMING** is not used and the following commands are unique to these synchronous, serial interfaces:

**IP•Tube Serial Clock Control**

The IP•Tube RS-530 and V.35 models provide DCE, (data communication equipment), interfaces. The DCE interface supplies both the Transmit Clock, (serial clock transmit, or SCT), and Receive Clock, (SCR), to the connected DTE (date terminal equipment) interface. The IP•Tube RS-530 and V.35 models allow the user to configure these clocks to normal mode or to inverted mode. The DTE to which the IP•Tube connects may require inverted clock. The commands are:

**SCR NORMAL**

**SCT INVERTED**

**SCRCLOCK**

This command is used to clock the Receive Ethernet packet data from the buffer memory into the DTE.

**SCTCLOCK**

This command is used to clock data from the DTE into IP packets that are sent to the **TUBE ADDRESS**.

## IP•Tube RS530/RS232/V.35/X.21 Clock

The **TUBE CLOCK** command is used to set the source of the Serial Clock Receive and Transmit Timing signals. When **SCRCLOCK** needs to match the **SCTCLOCK** exactly with a smooth non gapped clock, **TUBE INTERVAL = 0**, then one of the IP•TUBE RS530/V.35's needs to have its **TUBE CLOCK** set to **INTERNAL** and the other needs to be set to **PLL** and **TUBE BUFFER**ing needs to be utilized.

**TUBE CLOCK INTERNAL**

**TUBE CLOCK PLL**

**IP•Tube SCxCLOCK MODE**

NX2K4, NX56K AND NX64K

**IP•Tube SCxCLOCK FACTOR**

Note: **TUBE SCxCLOCK MODE NXxxx** is multiplied by **SCxCLOCK FACTOR** to produce the **SCx-CLOCK**.

**NX2K4 2.4k** times factor. Maximum factor is 18.
Data rate from 2.4K to 43.2K.

**NX56K 56k** times factor. Maximum factor is 32.
Data rate from 56K to 1792K.

**NX64K 64k** times factor. Maximum factor is 32.
Data rate from 64K to 2048K.

**TUBE SCRCLOCK FACTOR value DIVIDEBY value**

**DIVIDEBY** applied to BOTH **SCR** and **SCT** clock settings and must be an EVEN number.

**DIVIDEBY** Minimum factor is 2

**DIVIDEBY** Maximum factor is 32

To turn off the **DIVIDEBY** function, symply do not enter the text after **SCRCLOCK FACTOR value**.

**IP•Tube SCRCLOCK MODE**

**TUBE SCRCLOCK MODE {NX2K4 | NX56K | NX64K}**

**IP•Tube SCRCLOCK FACTOR NN**

**TUBE SCRCLOCK FACTOR NN**

NN is the number that multiplies the mode, NX2K4, NX56K AND NX64K.

**IP•TUBE INTERVAL xx**

**Note: Tube Interval was used in legacy equipment and is left here for informational purposes. It is recommended that Tube Interval be set to 0.**

The **IP•Tube Interval** command is used to control the gapping of the transmit, (SCT), and receive, (SCR), clocks. Permitted values are 0 to 63. An **Interval** of 0 does not gap the clock. An **Interval** consists of the period defined by the Frames Per Packet times the Bytes Per Frame times the bits per byte divided by the **SCxCLOCK** setting. The Bytes Per Frame is set to 64. The **FPP** is user configurable and the bits per byte is 8.

**TUBE INTERVAL** is used to regulate the packet rate. Regulation of the packet rate provides for a mechanism to control the data rate of the IP•Tube RS530/V.35. The **Interval** setting can be utilized to clock data out of the DTE into a packet at its maximum clocking rate so as to minimize latency.

There are 2 methods of controlling the IP•Tube data rate. One method is to set the **SCxCLOCK** rates to the data rate required. This method can double the delay if in the IP•Tube network connection is a WAN link. The other method is to set the **SCxCLOCK** to the DTE's maximum clocking rate and regulate the packet rate with the **Interval** setting.

For an example on how to configure Tube Interval, the user will select Frames-Per-Packet = 10. With this TUBE FPP setting, the tables in Chapter 7 indicate an approximate 7% (ratio is 1.069) overhead. The WAN Point to Point Protocol overhead is off set with the Ethernet MAC addresses not being transported across the WAN link although the HDLC framing does bit stuffing that could bump the

data bandwidth by 8%. So the total overhead is 7% for the IP/UDP plus 8% for bit stuffing.

Therefore the desired clock rate on RS530 is 64Kbps/1.15 = 55Kbps. In order to minimize the latency involved in clocking the data from the encrypter's serial interface the encrypter will be clocked at its maximum rate and the Tube Interval setting will be used to hold off clocking the next packet of data until the ISDN WAN router has been able to transmit the prior packet.

To determine the Tube Interval setting take the maximum clocking rate of the DTE divide it by the data rate and subtract one. The encrypter's maximum clocking rate is 2.048Mbps.

Divisor = 2,048,000/55,000 = 37.2.
Round down 2,048,000/37 = 55,351

Note: Slightly greater clocking rate is okay since bit stuffing of 8% is worst case of every data byte being stuffed.

Interval = Divisor minus 1 = 36

Note: The time of clock gapping equals:

((FPP * BytePerFrame* BitsPerByte)/2.048Mbps) times Interval
FPP = 10; BPP = 64; SCRCLOCK = 55,351; Interval = 36
(10 * 64*8)/ 2,048,000 * 36 = 0.09 = 90 milliseconds

This amount of gap can result in synchronization mode limitations. The clock gapping delay can be reduced by reducing the FPP (overhead impact) and the SCTCLOCK base rate (latency impact) which is set to maximum in this example.

**TUBE INTERVAL xx**

**IP• TUBE PERCENTAGE**

The **TUBE PERCENTAGE** parameter, in conjunction with the **SCxCLOCK MODE/FACTOR** and **TUBE INTERVAL** setting, controls the transmit, (SCT), and receive, (SCR), clocking on the RS-530/V.35 serial interface. A detailed discussion of data bandwidth and clock rate, and how **TUBE FPP**, **TUBE INTERVAL** and **TUBE PERCENTAGE** settings affect them can be found in Chapter 6: *IP•Tube Configuration & Operation*.

# Chapter 3

# Installation of the IP•Tube

This chapter provides details on the physical connections required for the installation of Engage IP•Tube equipment and the initial communication with the IP•Tube via the console port.

References are made to the *Configuration and Operation* of the IP•Tube as well as to the *Command Line Interface* (CLI). These topics are covered in detail in later chapters.

## Installation Requirements

The use of Engage IP•Tube systems to create a TDM-over-IP or SynchronousData-over-IP connection requires one IP•Tube at each end of the IP connection.

A standard IP•Tube package includes:

- IP•Tube unit - with installed WAN interfaces: DLT1, DLE1, GT1, GE1, RS530, RS232, V.35, T3 or E3
- Console port adapter and cable
- One cross-over T1/E1 cable (DLT1/DLE1/GT1/GE1 models only)
- RJ45 to DB15 male adapter for 120 ohm balanced (GE1/DLE1 only)
- Power Converter  (110 or 220 Vac input/24 Vac or 24 Vdc output)
- Documentation CD with *IP•Tube User's Guide*

## Installing the Hardware

### Locating the IP•Tube

Site consideration is important for proper operation of the IP•Tube. The user should install the unit in an environment providing:

- A well-ventilated indoor location
- Access within six feet of a power outlet
- Two feet additional clearance around the unit to permit easy cabling connection

The IP•Tube can be mounted on a standard 19 inch equipment rack, available from Engage.

### Powering the IP•Tube

Engage IP•Tube units utilize an external power adapter, available in 110 VAC and 220 VAC versions, providing AC output.

The appropriate power adapter is provided with each unit. Ensure the power adapter is not connected to power before plugging the AC adapter into the rear panel power connector.

Connect the power adapter to an appropriate AC power outlet and check the power led on the front panel of the Engage IP•Tube. The power led will be a steady green when the internal diagnostics have completed.

## Console Port

All IP•Tube models include a Console port for configuration. The Console port may be used for serial communication from a local workstation. IP•Tube models utilize an RJ45 jack for the Console port. The Console port is configured as a DCE (Data Communication Equipment) port.

An RJ45 to DB9 adapter is provided with the IP•Tube which provides a physical interface permitting direct connection to DTE equipment, such as the COM1 interface of a PC.

Pinouts for the Console port, as well as Engage supplied adapters, are provided in the *Appendices*.

Communication to the console port should be set for,

**9600 baud, 1 stop bit, no parity, 8 bit fixed, flow control none.**

Once a serial connection between a workstation and the IP•Tube Console port is established and a carriage return **<CR>** is entered, a **LOGIN** prompt will appear.

The default **Login** is: **root**.
No password is needed until it is user set. The command **PASSWD** can be used to set a password.

## Configuring the Engage IP•Tube for the LAN

The IP•Tube needs to be configured with a number of parameters for proper operation on the local area network including:

- Ethernet IP address and subnet mask
- IP data target unit IP address and subnet mask
- Default gateway if the IP data target is on another IP network

The configuration procedure depends on the network environment in which the IP•Tube is to be installed.

Note: It is strongly suggested that you configure the IP•Tube with its unique network identity before making any Ethernet or Wide Area connections.

## Ethernet Interface

The DLT1/GT1/DLE1/GE1/RS530LS/RS530HS/RS232/V.35LS/V.35HS models use a 10/100BaseT to connect to the Local Area Network. Each system provides two 10/100BaseT interfaces for connection to an Ethernet switch or hub using a straight-thru Ethernet cable. For direct connection to a PC or other LAN device, the user should obtain a 10/100BaseT crossover cable.

The IP•Tube UNO use a 10/100BaseT to connect to the Local Area Network. Same as described above with the exception that the UNO has a single Local Area Network port.

The IP•Tube G4 use a 10/100BaseT switch to connect to the Local Area Network. Each system provides a total of five ports. Four of which are connected together as a switch (LAN1 - ETH1, ETH3-ETH5) and the remaining one is a standalone port (LAN2 - ETH2). This product has Auto MDI/MDIX Crossover sensing and will determine whether or not it needs to interchange cable sense between pairs so that an external crossover cable is not required.

10/100BaseT Ethernet cabling and crossover pinouts are provided in the *Appendices*.

# IP•Tube Serial Interface Options

## T1/fractional T1 Interface

The internal T1/fracT1 interfaces, (S1, S2, S3, or S4), are used for T1 over IP connectivity. The interface connects to the T1 interface of T1 based telecommunication equipment such as a PBX or a T1 Multiplexer. This connection uses a panel RJ48 jack and accepts 8 pin modular plugs. T1/fracT1 circuits use pins 1&2 for RxData and 4&5 for TxData. See *Appendices* for the T1 interface pinout.

The T1/fracT1 interface can be configured to operate at rates from 64Kbps to full T1 at 1.544 Mbps. The IP•Tube can be configured to transport T1 Framing bits.

All configurations items, including Line Coding, Framing and TxData timing, are configurable using the Command Line Interface, (CLI).

## E1/fractionalE1 Interface

The internal E1/fractional E1 DSU/CSU permits direct connection to the E1 interface of E1 based telecommunication equipment such as a PBX or an E1 Multiplexer. This connection uses a panel RJ48 jack and accepts 8 pin modular plugs. E1/fracE1 circuits use pins 1&2 for RxData and 4&5 for TxData. An RJ48/DB15 adapter cable is available if the E1 line is terminated in a 15 pin male "D" connector. See *Appendices* for E1 pinout and cable specification.

Note: The E1 interface is 120 ohm, balanced. The E1 RJ45 interface is converted to the E1 120 balanced DB15 Male interface via an RJ45 to DB15 male adapter.

The E1/fracE1 interface can be set to run at rates from 64Kbps to full E1 speed of 2.048 Mbps.

All configuration items, including Line Coding and Clock Source, are configurable using the Command Line Interface.

## RS530 Interface

The IP•Tube RS530 model provides a standard RS530 synchronous serial interface for connection to Data Terminal Equipment (DTE) or Data Communication Equipment (DCE) such as Encrypters, Terminal Servers, Video Codecs, and WAN Routers. The IP•Tube RS530 encapsulates the serial data into IP packets for transmission over Ethernet.

The RS530 interface is provided via a 25 pin "D" connector on the rear panel. See the *Appendices* for pinouts, signal names and directions. The RS530 interface on the IP•Tube is configurable as a Data Communication Equipment (DCE) interface or as a Data Terminal Equipment (DTE) interface. As a DCE it provides TxClk and RxClk to the connected DTE.

The DCE model must have a configured data rate through the IP•Tube RS530 by setting timing parameters which control the TxClk and RxClk. The size and frequency of the IP packets can be controlled, yielding data rates ranging from 8 Kbits/sec to 1.544 Mbits/sec. *Chapter 7: IP•Tube RS530DL/ RS530HS/RS232/X.21/V35/ and IP•Tube SER RS530/RS232/V35* provides an explanation of the commands and their effect.

## RS232 Interface

The IP•Tube RS232 model provides a standard RS232 synchronous serial interface for connection to Data Terminal Equipment (DTE) or Data Communication Equipment (DCE) such as Encrypters, Terminal Servers, Video Codecs, and WAN Routers. The IP•Tube RS232 encapsulates the serial data into IP packets for transmission over Ethernet.

The RS232 interface is provided via a 25 pin "D" connector on the rear panel. See the *Appendices* for

pinouts, signal names and directions. The RS232 interface on the IP•Tube can be ordered as a Data Communication Equipment (DCE) interface or as a Data Terminal Equipment (DTE) interface. As a DCE it provides TxClk and RxClk to the connected DTE.

The DCE model must have a configured data rate through the IP•Tube RS530 by setting timing parameters which control the TxClk and RxClk. The size and frequency of the IP packets can be controlled, yielding data rates ranging from 2.4 to 250Kbits/sec. *Chapter 7: IP•Tube RS530DL/RS530HS/ RS232/X.21/V35/ and IP•Tube SER RS530/RS232/V35* provides an explanation of the commands and their effect.

### V.35 Interface

The IP•Tube V35 model provides a V.35 synchronous serial interface for connection to Data Terminal Equipment, (DTE), or Data Communication Equipment, (DCE), such as Encrypters, Terminal Servers, Video Codecs, and WAN Routers. The IP•Tube V35 encapsulates the serial data into IP packets for transmission over Ethernet.

The V.35 interface is provided via a 25 pin "D" connector on the rear panel, though this pinout differs from that of the IP•Tube RS530. See the *Appendices* for pinouts, signal names and directions. The V.35 interface on the IP•Tube is built as a Data Communication Equipment, (DCE), interface or as a Data Terminal Equipment, (DTE), interface. As a DCE it provides TxClk and RxClk to the connected DTE.

The DCE model must have a configured data rate through the IP•Tube V.35 by setting timing parameters which control the TxClk and RxClk. The size and frequency of the IP packets can be controlled, yielding data rates ranging from 8 Kbits/sec to 1.544 Mbits/sec. *Chapter 7: IP•Tube RS530DL/ RS530HS/RS232/X.21/V35/ and IP•Tube SER RS530/RS232/V35* provides an explanation of the commands and their effect.

## Status LEDs

Front panel LEDs provide Power, Ethernet and Serial Interface status.

**Power** - The Power LED is normally green, although at power-on it may briefly blink if a firmware upgrade, (TFTP upgrade stored in the FLASH ROM) is being loaded.

**Ethernet**

The IP•Tube T1 provides specific information, with EthRX and EthTX indicators providing status on packet transmission and receipt, respectively, on the Ethernet interface:

- When receiving, the RxD will show a steady GREEN
- When transmitting, the TxD will show a steady GREEN

**Serial Interfaces**

The IP•Tube provides specific information, with TD and RD indicators providing status on valid framing from the T1/E1device or line to which the IP•Tube is connected. In addition, ST and LNK indicators provide link status, communication processor and framing, respectively, from the T1/E1device or line to which the IP•Tube is connected.

There are four indicators, S1 through S4 indicators providing status on valid framing from the T1 device or line. Please note that the S1 through S4 indicators will only show connections for the amount of ports purchased:

- When transmitting, the TD will show a steady GREEN
- When receiving, the RD will show a steady GREEN. If the IP•Tube is unable to

receive valid frames from other equipment, via the T1/E1 line, the RD will be off

- When the communication processor recognizes the port, ENA will show a stead GREEN
- For correct framing status, LNK will indicate a steady GREEN

### IP•Tube RS530/RS232/V.35 models

**Ethernet**

IP•Tube RS530, RS232 and V.35 models provide specific information, with EthTx and EthRx indicators providing status on packet transmission and receipt, respectively, on the Ethernet interface:

- When receiving, the RD will show a steady GREEN
- When transmitting, the TD will show a steady GREEN

**Serial Interfaces**

IP•Tube RS530. RS232 and V.35 models provide RD and TD LED's which indicate packet receipt and transmission, respectively, on the serial interface:

- When receiving packets, the RD will show a steady GREEN
- When transmitting packets, the TD will show a steady GREEN

## Internal Switches

IP•Tube DL, G, RS530, RS232, V.35, X.21 and T3/E3 systems contain an internal four position DIP Switch which is accessible by removing the unit rear panel and sliding out the motherboard.

The default setting for all DIP switches is **OFF**.

**Switch 1** - Power cycling the unit with DIP Switch 1 ON forces the IP•Tube, all models, to return to operating from Base Flash and deleting any downloaded upgrades. Ensure Switch 1 is returned to the OFF position after clearing an upgrade so future upgrades can be performed successfully.

**Switch 2** - Applies only to IP•Tube C units - with lossless DS0 compression. Setting to ON will disable the compression. Note: this must be done at each IP•Tube and a RESTART or power cycle executed.

**Switch 3** - Switch 3 is used during manufacturing to test the VCXO. The switch must be set to OFF for normal operation.

**Switch 4** - When turned ON, it forces the IP•Tube into a loopback mode. This is useful for troubleshooting the Telco/Serial connection.

The IP•Tube UNO and G4 has a single pushbutton switch (**SW2**). When holding this switch durring the boot cycle it will do the following:

- Force operation from Base Flash and delete downloaded upgrades.

On the UNO, the switch is accessable through the rear panel via a paperclip.

On the G4, the rear panel must be removed and the motherboard slid out a bit to access the switch.

# Assured Delivery Protocol

The IP•Tube Assured Delivery Protoco,l (ADP) offers reliable delivery of IP•Tube packets in an unreliable network environment. ADP can re-sequence packets delivered out of order and detect and retransmit missing packets. ADP achieves it's purpose by including acknowledgements of received Tube packets in every Tube packet sent. The receiving Tube can then detect and retransmit missing packets.

## The ADP Window

ADP depends on a "window" of time to achieve reliability. This window of time is controlled by the **Tube Buffers** and **Frames Per Packet**, (**FPP**), configuration parameters. The window needs to be large enough to allow detection and retransmission of missing packets.

The window can be expressed in terms of packets or time. Tube Buffers specify the window in terms of packets. The combination of **Tube Buffers** and **Frames Per Packets** specifies the window in terms of time.

Every 8 **Frames Per Packet** is one millisecond of time. Therefore, the number of **Frames Per Packet** divided by 8, times the number of **Tube Buffers** yields the time, in milliseconds, of the ADP window:

**(FPP/8) x <Tube Buffers> = ADP Window (milliseconds)**

The ADP "window" is the delay created by buffering packets on the transmit side of the Serial port.

## Configuring Tube Buffers for ADP

**Round Trip Delay** is the time it takes for an ADP packet to be sent and its acknowledgement received under normal conditions. This can usually be determined by issuing a ping command to a remote tube to determine the round trip time.

Note: A ping from a workstation is likely to give a more accurate round trip time than a ping from an IP•Tube.

**Tube Buffers** and **Frames Per Packet** should be configured for at least one and a half times the **Round Trip Delay**. Normally, it should be twice the **Round Trip Delay**. If **Round Trip Delay** is short, it can be much more.

In general, the larger the difference between the size of the ADP window and the **Round Trip Delay**, the higher the probability that ADP can recover missing packets.

It is more advantageous for the ADP protocol if the ADP window is increased by increasing **Tube Buffers** rather than increasing **Frames Per Packet**.

For the ADP protocol to work properly, **Tube Buffers** and **Frames Per Packet** must be set to the same value on the local and remote Tubes.

## Retransmission

Every time the IP•Tube has a Tube packet to send, the ADP protocol determines whether to Retransmit any missing packets as well. The configuration parameters **LimitRetransmit**, **DelayRetransmit**, and **CountRetransmit** are used to shape the algorithm that determines which unacknowledged packets are retransmitted.

The **LimitRetransmit** configuration parameter determines the maximum number of packets ADP will Retransmit after it has sent a Tube packet. Unacknowledged packets not retransmitted because of **LimitRetransmit** have priority for retransmission after the next Tube packet is sent.

**LimitRetransmit** typically should be set to 2. In bandwidth limited IP networks it can be set to 1 to

reduce load on the network. However, a value of 1 may not be sufficient if packet loss is high.

The **DelayRetransmit** configuration parameter determines how long ADP should wait before retransmitting an unacknowledged packet. The delay should be at least the "Round Trip Time", the time it takes for a Tube packet to travel to the remote Tube and for the acknowledgement to travel back.

To account for IP network jitter and a small delay inherent in ADP, **DelayRetransmit** should be configured to the value of "Round Trip Delay" plus 2.

The **DelayRetransmit** configuration parameter is specified in terms of packets. If working with "Round Trip Delay" in terms of time, convert to packets:

**Round Trip Delay (packets) = Round Trip Delay (milliseconds) x (FPP/8)**

The **CountRetransmit** configuration parameter determines how often a packet should be retransmitted. Typically this can be set to 1.

**CountRetransmit** can be thought of as a delay after a packet is first retransmitted before it is retransmitted again. ADP will wait **CountRetransmit** Retransmit cycles before it Retransmits the packet again. For example, if **CountRetransmit** is 3, then the retransmission of an unacknowledged packet occurs every third Tube packet sent.

In bandwidth limited IP networks where there is a significant "Round Trip Delay", **CountRetransmit** can be increased to avoid continuous retransmission of a missing packet for which acknowledgement will be delayed a significant amount of time.

**CountRetransmit** applies to each packet independently of **LimitRetransmit**. ADP will always Retransmit, at most, **LimitRetransmit** number of packets after a Tube packet is sent. ADP may choose not to Retransmit a particular packet because it had previously been retransmitted and has yet to execute **CountRetransmit** number of Retransmit cycles.

### Assured Delivery Command Line Interface

**PROTOCOL {IPTUBE | CESOIP | ADPIPTUBE}**

To use ADP specify WAN protocol **ADPIPTUBE**.

**PROTOCOL ADPIPTUBE DELAYRETRANSMIT NN**

Specify **NN** for the delay before the **ADPIPTUBE** protocol Retransmits an unacknowledged packet. The delay is specified in terms of Tube packets.

**PROTOCOL ADPIPTUBE LIMITRETRANSMIT NN**

Specify **NN** for the maximum number of unacknowledged packets the **ADPIPTUBE** protocol Retransmits after transmitting an IP•Tube packet.

**PROTOCOL ADPIPTUBE COUNTRETRANSMIT NN**

**NN** specifies the minimum interval, expressed in terms of Tube packets, before a retransmitted packet is retransmitted again.

## Protector Option

The IP•Tube Protector offers a failover path to LAN2 if the LAN1 link quality reaches an unacceptable level. The link quality is determined by a set of configurable factors. When the link quality returns to an acceptable level, the IP•Tube data path returns to LAN1.

## Protector Operation

The Protector monitors incoming packets for link quality over a period of time. The period of time is specified by **Tube Protector PollingPeriod**. Incoming packets are monitored for percentage of expected packets actually received, the number of packets received out of sequence, the number of times the serial transmit buffer overflows, and the number of times the serial transmit buffer underruns. The threshold for each are independently configured. If any are exceeded during a **PollingPeriod**, the Protector fails over to LAN2.

When failed over to LAN2, the Protector continues to monitor LAN1. If over a period of time, specified by **Tube Protector Qualification**, the quality of incoming packets meets all the configured thresholds, the IP•Tube switches back to LAN1.

If the IP•Tube loses the link on the LAN1 port (i.e. the cable is pulled), the Protector immediately fails over to LAN2.

While failed over to LAN2, the Protector monitors LAN1 and LAN2 for the configured thresholds. If over a **Qualification** period of time LAN1 has better link quality than LAN2, the Protector switches back to LAN1. This is done even if LAN1 has not met the threshold criteria. Thus the Protector always switches back to LAN1 if the LAN2 link quality is worse than LAN1.

When the Protecter fails over to LAN2, it is only altering its receive path. It requests the remote IP•Tube Protector to begin transmitting on LAN2, but does not itself begin transmitting on LAN2. It would only do so if the remote IP•Tube had determined to fail over and requested the local IP•Tube to begin transmitting on LAN2. Thus the Protector on each IP•Tube operates in an independant, unidirectional mode. When its LAN receive link quality degrades, it asks to receive on a different path.

The state of the Protector can be determined by displaying the output of the **Show Info** command. The Protector Receive Port is the LAN on which the IP•Tube is receiving, a determination made by the local IP•Tube Protector. The Protector Transmit Port is the LAN on which the IP•Tube is transmitting, a determination made by the remote IP•Tube Protector.

When the Protector fails over to LAN2 there may be a small delay between the time it switches to receiving on LAN2 and the time the remote Protector actually begins transmitting on LAN2. This delay can cause a brief loss of service and can be eliminated by turning **Tube Protector Hardswitch Off**. In that case, the Protector always transmits on LAN2 making the data on the failover path constantly available to a remote Protector.

## Enhanced Mode Protector Option

Enhanced Mode, optional, is designed to accommodate the packet arrival delay that can occur between LAN1 and LAN2 packet networks. Buffering is added to the faster path so that packet loss on one link is replaced with a packet from the other link without a fault. Enhanced mode is specifically designed to work with the difference between Satellite and Terrestial network delays.

Interoperability requires recieving IPTube also be configured for Enhanced Mode since Enhanced Mode uses 16 bit sequence numbers. The Secondary Queue from LAN2 provides redundancy for LAN1 packet loss or outage. Buffers are synchronized with LAN1 buffer to hold up to 500 milliseconds of delay from LAN1.

## Considerations for Network Conditions

If there are asymetrical conditions on a network, there may be instances where a local IP•Tube has failed over to LAN2, but the remote IP•Tube has not. If LAN1 and LAN2 have a difference in packet delay, there is a corresponding difference in packet sequence number between LAN1 and LAN2. If the difference in packet sequence number is sufficiently large, when switching to LAN1 or LAN2 there may be a very brief loss of data as the IP•Tube must synchronize to the packet sequence of the new data stream.

## Protector Configuration

Saving configuration on the Serial Port causes a resetless configuration change to take place. This results in a temporary loss of service that, while short in duration, may cause a Protector on the remote IP•Tube to fail over to LAN2. When this occurs, it will be a **Qualification** period of time before the remote IP•Tube fails back to LAN1.

## Protector Command Line Interface

**TUBE LANPORT PROTECTOR**
Select **Tube LANport PROTECTOR** to place the IP•Tube in Protector mode. Protector mode requires the proper configuration of Tube 1 and Tube 2 Destination, UDPPORT, TOS, Ethernet Arp, and Ethernet Address. Tube 1 and Tube 2 correspond to the Tubes for LAN1 and LAN2 respectively.

**TUBE PROTECTOR HARDSWITCH {ON | OFF}**
When **HardSwitch** is **On**, the Protector transmits on LAN2 only when the remote Protector requests a fail over to LAN2.

When **HardSwitch** is **Off**, the Protector transmits on LAN2 and LAN1.

Note: Tube Protector HardSwitch if forced ON for IP•Tube T3 and E3 products. HardSwitch OFF is not supported. RxOutOfSequence, TxDrainDrops and TxUnderruns are not supported as failover criteria for T3 and E3 products.

**Hardswitch On** can be used in cases where the failover LAN2 path is a Bill On Demand circuit and connection time is to be kept to a minimum. **Hardswitch Off** can be used is cases where network bandwidth and cost is not an issue.

**TUBE PROTECTOR ENHANCED MODE {ON | OFF}**
Enhanced Mode, optional, is designed to accommodate the packet arrival delay that can occur between LAN1 and LAN2 packet networks. Buffering is added to the faster path so that packet loss on one link is replaced with a packet from the other link without a fault.

**TUBE PROTECTOR TRANSMITTER {ON | OFF}**
Turning Transmitter OFF, on the receive side only, is for use with simplex applications such as one way satellite broadcasts.

**TUBE PROTECTOR RECEIVER {ON | OFF}**
Turning Receiver OFF prevents the reception of Tube packets. This should only be used on simplex circuits at the trasmit side.

**TUBE PROTECTOR POLLINGPERIOD NN**
**PollingPeriod** determines the length of time the Protector evaluates the failover criteria, **RxOutOfSequence**, **RxPacketPercent**, **TxDrainDrops**, and **TxUnderruns**. If during a **PollingPeriod** any of the failover criteria does not meet their configured values, the Protector fails over to LAN2.

Setting a lower value of **PollingPeriod** shortens the time to fail over to LAN2 in the event of a network failure, but increases the possibility of failing over on a transient network event. Conversely, setting a higher value of **PollingPeriod** increases the time to fail over, but decreases the possibility of failing over on a transient network event.

The **PollingPeriod** is specified in terms of seconds. The range of values is from 1 to 60.

**TUBE PROTECTOR QUALIFICATION NN**
**Qualification** determines the length of time the Protector evaluates the quality of the LAN1 link and makes a determination whether to switch back from LAN2 to LAN1. The Protector switches back to LAN1 if LAN1 met its failover criteria over the **Qualification** period. The Protector also switches back to LAN1 if failover ciriteria statistics are worse for LAN2 than LAN1 over the **Qualification** period, even if LAN1 did not meet its criteria.

**Qualification** is specified in terms of minutes. The range of values is from 1 to 10.

**TUBE PROTECTOR RXOUTOFSEQUENCE NN**
**RxOutOfSequence** is failover criteria representing IP•Tube packets received **OutOfSequence**. Packets out of sequence can be due to missing packets or packet re-ordering by the network.

The range of values is from 5 to 200.

If in a **PollingPeriod** received packets **OutOfSequence** exceeds **RxOutOfSequence**, the Protector fails over from LAN1 to LAN2.

If in a **Qualification** time received packets out of sequence do not exceed **RxOutOfSequence**, the Protector switches back from LAN2 to LAN1.

Received packets out of sequence for a serial interface can be displayed by issuing the **Show Statistics** command.

**TUBE PROTECTOR RXPACKETPERCENT NN**
**RxPacketPercent** is failover criteria representing the percent of IP•Tube packets received to the number of IP•Tube packets expected. Missing packets would cause the percentage to fall.

**RXPacketPercent** is specifed in terms of percent and the range of values is from 50 to 100 percent.

If in a **PollingPeriod** the percentage of received packets to expected packets is less than **RxPacketPercent**, the Protector fails over from LAN1 to LAN2.

If in a **Qualification** time the percentage of received packets to expected packets is not less than **RXPacketPercent**, the Protector switches back from LAN2 to LAN1.

**TUBE PROTECTOR TXDRAINDROPS NN**
**TxDrainDrops** is failover criteria representing received IP•Tube packets dropped because the Tube serial transmit buffer has grown too large. It can be thought of as a Tube buffer overflow.

**DrainDrops** can be observed as **Transmit DrainDrops** by issuing the **Show Statistics** command.

**DrainDrops** can occur because the remote IP•Tube is sending IP•Tube packets on the LAN at a rate faster than the local IP•Tube is transmitting on the serial port, or the IP network has delayed, bunched, then released IP•Tube packets, or the serial transmitter has stopped transmitting.

If in a **PollingPeriod** the number of **DrainDrops** detected exceeds **TXDrainDrops**, the Protector fails over from LAN1 to LAN2.

If in a **Qualification** time the number of **DrainDrops** is does not exceed **TxDrainDrops**, the Protector switches back from LAN2 to LAN1.

The range of values is from 5 to 200.

**TUBE PROTECTOR TXUNDERRUNS NN**
**TXUnderruns** is failover criteria representing the number of serial interface transmit underruns. A serial underrun occurs when the Tube buffer is depleted. This can happen because the flow of incoming IP•Tube packets from the LAN is stopped or the rate of incoming packets is less than the rate the IP•Tube is transmitting on the serial port.

The range of values is from 5 to 200.

If in a **PollingPeriod** the number of serial interface transmit underruns exceeds **TXUnderruns**, the Protector fails over from LAN1 to LAN2.

If in a **Qualification** time the number serial interface transmit underruns does not exceed **TxUnderruns**, the Protector switches back from LAN2 to LAN1.

Serial interface transmit underruns are displayed as Transmit UN errors by issuing the **Show Statistics** command.

## Switch Option

The **Switch Option** enables the S1 interface to be manually switched between a T1/E1 circuit connected to the S2 interface or to T1/E1 over IP packets connected with a remote IP•Tube. This gives remote control of a T1/E1 connection to the Telco or T1/E1 over IP. Installation can be performed by a single technician and facilitates quick reversion to the Telco T1/E1 link during debug of T1/E1 over IP.

The **Switch Option** is controlled by the **PassThru** configuration item using the Command Line Interface. When **PassThru** is **Off**, the IP•Tube operates in the normal manner with T1/E1 over IP running on the S1 interface and S2 interface if enabled. When **PassThru** is **On**, the circuit on the S1 interface is passed through the S2 interface. T1/E1 over IP is turned **Off**. When **PassThru** is **On**, configuration is altered from normal IP•Tube configuration in the following way.

S1 **Tube Framing** determines whether framing information is passed through to S2. If S1 **Tube Framing T1framed** or **E1framed** is chosen, the framing bit in the case of T1 or the framing byte in the case of E1 is passed through to S2. If S1 **Tube Framing Transparent** is chosen, the S2 interface generates the T1 framing bit or the E1 framing byte independent of the S1 interface. In this case, there is no multiframe alignment between the S1 and S2 interfaces. The configuration of S2 **Tube Framing** has no effect. All other S1 and S2 Tube configuration parameters have no effect. The S1 T1 configuration parameters, **Data, LBO, Framing, Coding, IdleCharacter**, and **Channels** are automatically selected for the S2 interface as well.

For the IP Tube G product, S1 **PassThru** interface is S2 and S3 **PassThru** interface is S4. To prevent confussion, the manual will discuss operation using the S1 and S2 interfaces. Interface S3 and S4 will operate just as S1 and S2 respectively.

### Switch PassThru Clock

To determine clocking when **PassThru** is **On**, the **T1 PassThru** configuration parameter is used. The T1 Clocking configuration parameter is ignored. A clock master may be connected to the S1 interface, connected to the S2 interface between two IP•Tubes in **PassThru** mode, or connected to the S2 interface of the remote IP•Tube. Whatever the case, there should be only one clock master.

If the clock master is connected to the S1 interface, set **T1 PassThruClock Network** for the S1 interface and **T1 PassThruClock Internal** for the S2 interface.

**Interface S1**
**T1/E1 PassThruClock NETWORK**

**Interface S2**
**T1/E1 PassThruClock INTERNAL**

If the clock master is connected to the S2 interface or connected to the S1 interface of the remote Tube, set **T1 PassThruClock TEL2** for the S1 interface and **T1 PassThruClock Network** for the S2 interface.

**Interface S1**
**T1/E1 PassThruClock TEL2**

**Interface S2**
**T1/E1 PassThruClock NETWORK**

If you wish to set the IP•Tube as the Clock Master, set **T1 PassThruClock TEL2** for the S1 interface and **T1 PassThruClock Internal** for the S2 interface. The equipment connected to the S1 and S2 interfaces should be configured for slave timing. A remote IP•Tube in this configuration should be configured as if a clock master is connected on the S2 interface, (set **T1 PassThruClock TEL2** for the S1 interface and **T1 PassThruClock Network** for the S2 interface).

## Local IP•Tube Master Clocking

Local IP Tube

**Interface S1**
**T1/E1 PassThruClock TEL2**

**Interface S2**
**T1/E1 PassThruClock INTERNAL**

Remote IP•Tube

**Interface S1**
**T1/E1 PassThruClock TEL2**

**Interface S2**
**T1/E1 PassThruClock NETWORK**

**PassThru Status**
**PassThru Status** is displayed in the output of the **Show Configuration** and **Show Information** commands. The **PassThru** status indicates whether the Tube is operating in the **PassThru** mode or the **IP•Tube** mode.

## Configuration Considerations

If both Serial ports are enabled on the DLT1 IP•Tube, precaution must be taken when switching **PassThru On** and **Off**. When **PassThru** is **Off**, both Serial ports can participate in the T1 over IP functionality of the IP•Tube. That is, data from both Serial ports can be sent out the LAN ports in IP•Tube packets, if so configured. When using **PassThru** as a switch, configure S2 Tube **Off** so that when **PassThru** is **Off**, there is no data passed between the S2 port and a LAN port.

## Switch Command Line Interface

**PASSTHRU {ON|OFF}**
**Passthru Off** results in normal IP•Tube operation.
**Passthru On** switches the S1 port directly to the S2 port. There is no T1/E1 over IP.

**S1 T1/E1 PASSTHRUCLOCK {NETWORK|INTERNAL|TEL2}**
**PassThruClock** detefmines the Clocking for a Serial interface when **Passthru** is **On**. When **Passthru** is **Off**, the Clocking for a Serial interface is determined by the T1/E1 Clock setting.

Configure **T1/E1 Passthruclock** in the following manner:

Clock Master Connected to the S1 Interface

**Interface S1**
**T1/E1 PassThruClock NETWORK**

**Interface S2**
**T1/E1 PassThruClock INTERNAL**

Clock Master Connected to the S2 Interface or the S1 Interface of a Remote IP•Tube

**Interface S1**
**T1/E1 PassThruClock TEL2**

**Interface S2**
**T1/E1 PassThruClock NETWORK**

IP•Tube as Clock Master
Local IP•Tube Master Clocking

**Interface S1**
**T1/E1 PassThruClock TEL2**

**Interface S2**
**T1/E1 PassThruClock INTERNAL**

Remote IP•Tube

**Interface S1**
**T1/E1 PassThruClock TEL2**

**Interface S2**
**T1/E1 PassThruClock NETWORK**

## Link Protector

The Link Protector Option provides an automatic T1/E1 over IP back up for T1/E1 circuits. The Link Protector detects a failed T1/E1 circuit and re-routes the traffic over the IP network.

The Link Protector Option is configured and operates in the same manner as the Switch Option with the following additions.

For the IP Tube G product, S1 **PassThru** interface is S2 and S3 **PassThru** interface is S4. To prevent confussion, the manual will discuss operation using the S1 and S2 interfaces. Interface S3 and S4 will operate just as S1 and S2 respectively.

### PassThru ProtectiveSwitch

The **PassThru ProtectiveSwitch** configuration parameter determines whether the switch to the IP network is automatic or manual. When **PassThru ProtectiveSwitch** is **Manual**, the Link Protector behaves in the same manner as the T1/E1 Switch feature. **PassThru On** and **Off** deterimines whether the S1 interface is switched to the S2 interface or to the LAN interface. When **PassThru ProtectiveSwitch** is **LinkProtector**, the **Link Protector** automatically switches between the S2 interface and the LAN interface.

### Link Protector Automatic Switch Criteria

The **Link Protector** maintains the connection to the S2 interface as long as there is no Loss of Signal, Loss of Framing, or AIS, (**Blue Alarm**), at the S2 port. If any of these conditions are detected at the S2 port, the Link Protector switches the S1 port to T1/E1 over IP. When all the conditions are cleared, the Link Protector switches the S1 port back to the S2 port. Optionally, a Yellow Alarm can be included in the conditions causing a switch. This can be set by configuring **Passthru ProtectiveSwitch AlarmHandling YELLOWALARM**.

The **PassThru ProtectiveSwitch LinkProtector** can be customized to test the links integrity of S2 before automatically switching to the LAN interface and back. These parameters are: **FailoverPeriod, FailoverThreshold, FailbackPeriod** and **FailbackThreshold**. The **FailoverPeriod** and **FailbackPeriod** is the sample period in seconds. The **FailoverThreshold** and **FailbackThreshold** are in terms of percent.

## Link Protector Command Line Interface

**PASSTHRU PROTECTIVE {LINKPROTECTOR | MANUAL}**
When Passthru Protective is Manual, the Link Protector operates in the manner of the **T1/E1** Switch Option. Switching between the S2 port and T1 over IP is acheived with PassThru On or Off.

When Passthru Protective is LinkProtector, the LinkProtector option is enabled. Switching between the S2 port and **T1/E1** over IP is automatic.

**PASSTHRU PROTECTIVE LINKPROTECTOR {YELLOWALARM | BLUEALARM}**
When **YELLOWALARM** is selected, a **YellowAlarm** indication on the TEL2 port causes a switch to T1/E1 over IP in addition to a Loss of Signal, Loss of Frame, or AIS, (**Blue Alarm**), condition.

When **BLUEALARM** is selected, only Loss of Signal, Loss of Frame, or AIS, (**Blue Alarm**), causes a switch.

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR FAILOVERPERIOD {NNN}**
Time in seconds that LinkProtector evaluates the integrity of the link. Valid range is 1 to 255 seconds.

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR FAILOVERTHRESHOLD {NNN}**
Percentage of errored seconds. If exceeded within the FailoverPeriod this will cause the path to failover to the LAN interface - IPTube protocol. Valid range is 1 to 100 percent

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR FAILBACKPERIOD {NNN}**
Time in seconds - LinkProtector evaluates the integrity of the link. Valid range is 1 to 255 seconds.

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR FAILBACKTHRESHOLD {NNN}**
Percentage of errored seconds - If NOT exceeded within the FailBackPeriod this will cause the path to failback to the S2 interface - PassThru protocol. Valid range is 1 to 100 percent

## Link Protector Alarm Relay Command Line Interface

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR ALARMRELAY**
**{ Off | LANFail | TELFail | LANorTELFail }**
Dependant upon the AlarmRelay setting, the IP•Tube will connect the contacts 1 and 2 of the relay on an alarm. Please see the Table 13 - Alarm Relay Contact in the *Appendix* for more information.

- **OFF** - The AlarmRelay is disabled.
- **LANFail** - The Alarm Relay closes if the unit detects it cannot reach the remote unit over the LAN. This alarm may go off even when the Link Protector status is Up and would be a problem if the unit needed to fail over to TDM over IP. The alarm ceases when IP connectivity to the remote unit is restored.
- **TELFail** - The Alarm Relay closes if the unit detects a link down on the thru TEL interface. It indicates the Link Protector status is in a Local Failed Over or Remote Failed Over state and the unit is passing data via TDM over IP.
- **LANorTELFail** - The Alarm Relay closes if either the LANFail or TELFail alarm is active.

The state of the Alarm Relay can be determined by displaying the output of the **Show Info** command within the global interface. Alarm Relay can be Off (Alarm Inactive) or On (Alarm Active).

**Alarm Relay Off - Reasons:**

- **Configured Off**
- **No Alarm**

**Alamr Relay On - Reasons:**

- **TEL1 LAN Remote Unreachable** - Local unit cannot reach the LAN port of the

Tube Destination in S1

- **TEL2 Local Failed** - Local unit lost connectivity to T1
- **TEL2 Remote Failed** - Local unit cannot reach remote unit on TEL2 port
- **TEL3 LAN Remote Unreachable** - Local unit cannot reach the LAN port of the Tube Destination in S3
- **TEL4 Local Failed** - Local unit lost connectivity to T1
- **TEL4 Remote Failed** - Local unit cannot reach remote unit on TEL4 port

**PASSTHRU STATUS:**
Reports the current status of the link. When reporting **PassThru**, data is being sent out the S2 interface. If reports **IP Tube**, data is being sent out the LAN interface.

## SNMP Support

All Engage products support Simple Network Management Protocol, (SNMP) version 1. SNMP support provides access via IP to groups of administrative, configuration-related, and statistical information objects about the Engage device. An Ethernet connection to the device and a PC with an application which provides an SNMP version 1 client are required.

An SNMP client will query the device and display the information objects and their values to the user. Groups of SNMP information objects are referred to as MIBs (Management Information Base). The Engage IP•Tube products support most of MIB-II (MIB-2). Subgroups of information in MIB-II are listed below.

Please email suport@engageinc.com for Engage Communication MIB Definitions.

System group: contains system information such as a designated system identifier, location, and vendor ID (Engage).

Interface group: contains information about the network connections on the device including interface type, link status, packets transmitted and received.

AT group: contains information about the ARP entries on the device including the values for MAC Address and IP Address for each entry.

IP group: contains IP statistics and configuration on the device including IP packets received, packets discarded, and IP address and subnet mask.

ICMP group: contains statistics for ICMP statistics including packets sent for redirect, port unreachable, or echo requests (Ping).

UDP group: contains statistics for UDP including packets received and transmitted, and packets sent to a UDP port with no listener.

SNMP group: contains statistics for the SNMP protocol including packets received and transmitted, error packets, and number of set requests.

For more detail, MIB-II is fully specified in RFC1213, available at http://www.faqs.org/rfcs/rfc1213.html.

The IP•Tube GT1 and GE1 support a generation of SNMPv1 Traps. Traps are messages sent from the device's LAN port when specific events occur.

The following traps may be generated:

- coldStart: this trap is generated if the Tube re-initializes itself after a configuration change.

- warmStart: this trap is generated if the Tube re-initializes itself after a reset which does not involve a configuration change.
- linkUp: this trap is generated when a physical interface transitions from being disconnected to connected.
- linkDown: this trap is generated when a physical interface transitions from being connected to disconnected.
- authenticationFailure: this trap is generated when a login to the user interface or an SNMPv1 SetRequest failed because an incorrect password was given.
- enterprisespecific: these are Engage proprietary traps.

We define the following subcategories:

- engageTrapRxOverrun: this trap is generated when excessive receiver overruns are happening on an interface.
- engageTrapTxUnderrun: this trap is generated when excessive transmitter underruns are happening on an interface.
- engageTrapBufferExhaustion: this trap is generated when the device runs out of free buffers for packet processing.
- engageTrapDeafness: this trap is generated when an interface on the box has not received packets for a long period of time.
- engageTrapTubeEnetRxAbsent: this trap is generated when an IP•Tube has not been receiving IP•Tube encapsulated IP packets on it's LAN Interface when it expects to be.

For more detail on the industry standard traps, please see http://www.faqs.org/rfcs/rfc1157.html.

# Chapter 4

## Configuration Examples

The following two examples are generic in that they will properly configure the most basic T1 Tube, with one to four ports. Use only the portion of the example that matches the number of ports that are being configured.

### Example #A: DLT1 Generic

# T1 IP•Tube Generic Example #A Unit A

config
interface

Host Name IPTube A
Host Location Site A
Telnet On
UserTimeout Off
snmp off
snmp traps off

**Interface LAN1**
Auto On
IP Address 192.168.1.50/24
Port On
BroadcastRcv On

**Interface LAN2**
Auto On
IP Address 192.168.2.50/24
Port Off
BroadcastRcv On

**Interface S1**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3175
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking Internal
T1 LBO CSU 0dB

T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 1 T1 port

**Interface S2**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3176
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking Internal
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 2 T1 ports

**Interface S3**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3177
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking Internal
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS

T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 3 T1 ports

**Interface S4**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3178
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking Internal
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 4 T1 ports

## # T1 IP•Tube Generic Example #A Unit B

config
interface

Host Name IPTube B
Host Location Site B
Telnet On
UserTimeout Off
snmp off
snmp traps off

**Interface LAN**
Auto On
IP Address 192.168.1.51/24
Port On
BroadcastRcv On

**Interface LAN2**
Auto On
IP Address 192.168.2.51/24
Port Off

```
BroadcastRcv On

Interface S1
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3175
Tube 1 TOS  48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data               Normal
T1 Clocking           V2PLL
T1 LBO           CSU  0dB
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter      0x7f
T1 TxUnderrunAIS      Off
T1 Channels           Full

# copy to here for 1 T1 port

Interface S2
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3176
Tube 1 TOS  48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data               Normal
T1 Clocking           V2PLL
T1 LBO           CSU  0dB
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter      0x7f
T1 TxUnderrunAIS      Off
T1 Channels           Full

# copy to here for 2 T1 ports
```

**Interface S3**
Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3177
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data  Normal
 T1 Clocking  V2PLL
 T1 LBO  CSU  0dB
 T1 Framing  ESF
 T1 Coding  B8ZS
 T1 IdleCharacter  0x7f
 T1 TxUnderrunAIS  Off
 T1 Channels  Full

# copy to here for 3 T1 ports

**Interface S4**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3178
Tube 1 TOS  48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data  Normal
T1 Clocking  V2PLL
T1 LBO  CSU  0dB
T1 Framing  ESF
T1 Coding  B8ZS
T1 IdleCharacter  0x7f
T1 TxUnderrunAIS  Off
T1 Channels  Full

# copy to here for 4 T1 ports

## Example #B: DLE1 Generic

# E1 IP•Tube Generic Example #2 Unit A

```
# IP•Tube A
# E1 IPTube Example

config
interface

Host Name IPTube A
Host Location Site A
Telnet On
UserTimeout Off
snmp off
snmp traps off

Interface LAN1
Auto On
IP Address 192.168.1.50/24
Port On
BroadcastRcv On

Interface LAN2
Auto On
IP Address 192.168.2.50/24
Port Off
BroadcastRcv On

Interface S1
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3175
Tube 1 TOS  48
Tube Buffers 5
Tube FPP 12
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

E1 Data              Normal
E1 Clocking          Internal
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     7F Hex
E1 TxUnderrunAIS     Off
E1 Channels          Full


# copy to here for 1 E1 port
```

**Interface S2**
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3176
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 12
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

E1 Data Normal
E1 Clocking Internal
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 7F Hex
E1 TxUnderrunAIS Off
E1 Channels Full

# copy to here for 2 E1 ports

**Interface S3**
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3177
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 12
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

E1 Data Normal
E1 Clocking Internal
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 7F Hex
E1 TxUnderrunAIS Off
E1 Channels Full

# copy to here for 3 E1 ports

**Interface S4**
Type E1
Protocol IPTube
Tube On

Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3178
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 12
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

E1 Data Normal
E1 Clocking Internal
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 7F Hex
E1 TxUnderrunAIS Off
E1 Channels Full

# copy to here for 4 E1 ports

# E1 IP•Tube Generic Example #B Unit B

config
interface

Host Name IPTube B
Host Location Site B
Telnet On
UserTimeout Off
snmp off
snmp traps off

**Interface LAN1**
Auto On
IP Address 192.168.1.51/24
Port On
BroadcastRcv On

**Interface LAN2**
Auto On
IP Address 192.168.2.51/24
Port Off
BroadcastRcv On

**Interface S1**
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT 3175
Tube 1 TOS 48
Tube Buffers 5

Tube FPP 12
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

E1 Data Normal
E1 Clocking V2PLL
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 7F Hex
E1 TxUnderrunAIS Off
E1 Channels Full

# copy to here for 1 E1 port

**Interface S2**
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT 3176
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 12
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

E1 Data Normal
E1 Clocking V2PLL
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 7F Hex
E1 TxUnderrunAIS Off
E1 Channels Full

# copy to here for 2 E1 ports

**Interface S3**
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT 3177
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 12
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On

Tube SequenceRecovery Off

E1 Data Normal
E1 Clocking V2PLL
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 7F Hex
E1 TxUnderrunAIS Off
E1 Channels Full

# copy to here for 3 E1 ports

**Interface S4**
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT 3178
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 12
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

E1 Data Normal
E1 Clocking V2PLL
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 7F Hex
E1 TxUnderrunAIS Off
E1 Channels Full

# copy to here for 4 E1 ports

## Example #C: DLT1 Generic providing 10mS Delay

T1 IPTube Example #C with alternate Buffer and FPP settings

- Can be used to configure 1 to 4 T1 ports
- Basic configuration
- Tube Buffers 5 and FPP 16 give 10 mS delay

**# T1 IP•Tube Unit A**
config
interface

Host Name IPTube A
Host Location Site A
Telnet On
UserTimeout Off

snmp off
snmp traps off

**Interface LAN1**
Auto On
IP Address 192.168.1.50/24
Port On
BroadcastRcv On

**Interface LAN2**
Auto On
IP Address 192.168.2.50/24
Port Off
BroadcastRcv On

**Interface S1**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3175
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking Internal
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 1 T1 port

**Interface S2**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3176
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On

Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking Internal
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 2 T1 ports

**Interface S3**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3177
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking Internal
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 3 T1 ports

**Interface S4**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3178
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking Internal
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 4 T1 ports

## # T1 IP•Tube Unit B

config
interface

Host Name IPTube B
Host Location Site B
Telnet On
UserTimeout Off
snmp off
snmp traps off

**Interface LAN1**
Auto On
IP Address 192.168.1.51/24
Port On
BroadcastRcv On

**Interface LAN2**
Auto On
IP Address 192.168.2.51/24
Port Off
BroadcastRcv On

**Interface S1**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT 3175
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking V2PLL
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f

T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 1 T1 port

**Interface S2**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT 3176
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking V2PLL
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

# copy to here for 2 T1 ports

**Interface S3**
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT 3177
Tube 1 TOS 48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data Normal
T1 Clocking V2PLL
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 TxUnderrunAIS Off
T1 Channels Full

```
# copy to here for 3 T1 ports

Interface S4
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3178
Tube 1 TOS  48
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off

T1 Data                Normal
T1 Clocking             V2PLL
T1 LBO             CSU  0dB
T1 Framing              ESF
T1 Coding              B8ZS
T1 IdleCharacter        0x7f
T1 TxUnderrunAIS        Off
T1 Channels             Full

# copy to here for 4 T1 ports

E1 IPTube Example

-Can be used to configure 1 to 4 E1 ports

-Basic configuration.

-Tube Buffers 5 and FPP 12 gives 7.5 mS delay.


# IPTube A
# E1 IPTube Example

co
int

Host Name IPTube A
Host Location Site A
Telnet On
UserTimeout Off
snmp off
snmp traps off

Interface LAN1
 Auto On
 IP Address 192.168.1.50/24
 Port On
 BroadcastRcv On
```

```
Interface LAN2
 Auto On
 IP Address 192.168.2.50/24
 Port Off
 BroadcastRcv On

Interface S1
 Type E1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3175
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 12
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 E1 Data               Normal
 E1 Clocking            Internal
 E1 Framing             CRC4
 E1 Coding              HDB3
 E1 IdleCharacter      7F Hex
 E1 TxUnderrunAIS        Off
 E1 Channels            Full


# copy to here for 1 E1 port

Interface S2
 Type E1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3176
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 12
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 E1 Data               Normal
 E1 Clocking            Internal
 E1 Framing             CRC4
 E1 Coding              HDB3
 E1 IdleCharacter      7F Hex
 E1 TxUnderrunAIS        Off
 E1 Channels            Full
```

```
# copy to here for 2 E1 ports

Interface S3
 Type E1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3177
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 12
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 E1 Data               Normal
 E1 Clocking            Internal
 E1 Framing             CRC4
 E1 Coding              HDB3
 E1 IdleCharacter      7F Hex
 E1 TxUnderrunAIS        Off
 E1 Channels            Full

# copy to here for 3 E1 ports

Interface S4
 Type E1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3178
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 12
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 E1 Data               Normal
 E1 Clocking            Internal
 E1 Framing             CRC4
 E1 Coding              HDB3
 E1 IdleCharacter      7F Hex
 E1 TxUnderrunAIS        Off
 E1 Channels            Full

# copy to here for 4 E1 ports
```

```
# IPTube B
# E1 IPTube Example

co
int

Host Name IPTube B
Host Location Site B
Telnet On
UserTimeout Off
snmp off
snmp traps off

Interface LAN1
 Auto On
 IP Address 192.168.1.51/24
 Port On
 BroadcastRcv On

Interface LAN2
 Auto On
 IP Address 192.168.2.51/24
 Port Off
 BroadcastRcv On

Interface S1
 Type E1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 12
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 E1 Data               Normal
 E1 Clocking            V2PLL
 E1 Framing             CRC4
 E1 Coding             HDB3
 E1 IdleCharacter      7F Hex
 E1 TxUnderrunAIS        Off
 E1 Channels            Full


# copy to here for 1 E1 port

Interface S2
 Type E1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
```

```
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3176
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 12
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 E1 Data               Normal
 E1 Clocking            V2PLL
 E1 Framing             CRC4
 E1 Coding             HDB3
 E1 IdleCharacter      7F Hex
 E1 TxUnderrunAIS        Off
 E1 Channels            Full

# copy to here for 2 E1 ports

Interface S3
 Type E1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3177
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 12
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 E1 Data               Normal
 E1 Clocking            V2PLL
 E1 Framing             CRC4
 E1 Coding             HDB3
 E1 IdleCharacter      7F Hex
 E1 TxUnderrunAIS        Off
 E1 Channels            Full

# copy to here for 3 E1 ports

Interface S4
 Type E1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3178
```

```
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 12
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 E1 Data               Normal
 E1 Clocking            V2PLL
 E1 Framing             CRC4
 E1 Coding              HDB3
 E1 IdleCharacter      7F Hex
 E1 TxUnderrunAIS        Off
 E1 Channels            Full

# copy to here for 4 E1 ports
```

Clocking Internal Example

-Site A IPTube is clocking Internal, Site B IPTube is clocking V2PLL. The IPTube is the source of the T1 clock. This is useful in test environments or when the IPTube is replacing a T1 segment that provided clock. Stand alone PBX to PBX configurations would require this clocking if neither PBX was providing clock.

-This is a T1 configuration. The T1 Clocking parameter in this example would apply to an E1 configuration as well.

```
# IPTube A
# T1 Clocking Internal Example

co
int

Host Name IPTube A
Host Location Site A
Telnet On
UserTimeout Off
snmp off
snmp traps off

Interface LAN1
 Auto On
 IP Address 192.168.1.50/24
 Port On
 BroadcastRcv On

Interface LAN2
 Auto On
 IP Address 192.168.2.50/24
 Port Off
 BroadcastRcv On

Interface S1
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
```

```
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3175
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           Internal
 T1 LBO          CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 1 T1 port

Interface S2
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3176
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           Internal
 T1 LBO          CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 2 T1 ports

Interface S3
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
```

```
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3177
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           Internal
 T1 LBO          CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 3 T1 ports

Interface S4
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3178
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           Internal
 T1 LBO          CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 4 T1 ports


# IPTube B
# T1 Clocking Internal Example

co
int

Host Name IPTube B
Host Location Site B
Telnet On
```

```
UserTimeout Off
snmp off
snmp traps off

Interface LAN1
 Auto On
 IP Address 192.168.1.51/24
 Port On
 BroadcastRcv On

Interface LAN2
 Auto On
 IP Address 192.168.2.51/24
 Port Off
 BroadcastRcv On

Interface S1
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           V2PLL
 T1 LBO            CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 1 T1 port

Interface S2
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3176
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
```

```
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           V2PLL
 T1 LBO           CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 2 T1 ports

Interface S3
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3177
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           V2PLL
 T1 LBO           CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 3 T1 ports

Interface S4
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3178
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off
```

```
 T1 Data               Normal
 T1 Clocking            V2PLL
 T1 LBO            CSU  0dB
 T1 Framing             ESF
 T1 Coding             B8ZS
 T1 IdleCharacter       0x7f
 T1 TxUnderrunAIS        Off
 T1 Channels           Full

# copy to here for 4 T1 ports
```

Clocking Network Example

-Site A IPTube is clocking Network, Site B IPTube is clocking V2PLL. The Site A IPTube is sourcing the clock from the T1 line. The Site B IPTube is recovering the clock from the Site A IPTube. The site A T1 is providing clock and the Site B T1 is receiving clock. This would be used in a scenario where one piece of equipment external to the IPTube is providing clock.

-This is a T1 configuration. The T1 Clocking parameter in this example would apply to an E1 configuration as well.

```
# IPTube A
# T1 Clocking Network Example

config
interface

Host Name IPTube A
Host Location Site A
Telnet On
UserTimeout Off
snmp off
snmp traps off

Interface LAN1
 Auto On
 IP Address 192.168.1.50/24
 Port On
 BroadcastRcv On

Interface LAN2
 Auto On
 IP Address 192.168.2.50/24
 Port Off
 BroadcastRcv On

Interface S1
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3175
 Tube 1 TOS  48
```

```
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           Network
 T1 LBO           CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 1 T1 port

Interface S2
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3176
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           Network
 T1 LBO           CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 2 T1 ports

Interface S3
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3177
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
```

```
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           Network
 T1 LBO           CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 3 T1 ports

Interface S4
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3178
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data               Normal
 T1 Clocking           Network
 T1 LBO           CSU  0dB
 T1 Framing            ESF
 T1 Coding             B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 4 T1 ports


# IPTube B
# T1 Clocking Network Example

co
int

Host Name IPTube B
Host Location Site B
Telnet On
UserTimeout Off
snmp off
snmp traps off

Interface LAN1
```

```
 Auto On
 IP Address 192.168.1.51/24
 Port On
 BroadcastRcv On

Interface LAN2
 Auto On
 IP Address 192.168.2.51/24
 Port Off
 BroadcastRcv On

Interface S1
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data              Normal
 T1 Clocking           V2PLL
 T1 LBO           CSU  0dB
 T1 Framing            ESF
 T1 Coding            B8ZS
 T1 IdleCharacter      0x7f
 T1 TxUnderrunAIS      Off
 T1 Channels           Full

# copy to here for 1 T1 port

Interface S2
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3176
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data              Normal
 T1 Clocking           V2PLL
```

```
 T1 LBO            CSU  0dB
 T1 Framing             ESF
 T1 Coding              B8ZS
 T1 IdleCharacter       0x7f
 T1 TxUnderrunAIS       Off
 T1 Channels            Full

# copy to here for 2 T1 ports

Interface S3
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3177
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data                Normal
 T1 Clocking            V2PLL
 T1 LBO            CSU  0dB
 T1 Framing             ESF
 T1 Coding              B8ZS
 T1 IdleCharacter       0x7f
 T1 TxUnderrunAIS       Off
 T1 Channels            Full

# copy to here for 3 T1 ports

Interface S4
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Transparent
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3178
 Tube 1 TOS  48
 Tube Buffers 5
 Tube FPP 16
 Tube Duplicates 0
 Tube Compression Off
 Tube 1 Ethernet Arp On
 Tube SequenceRecovery Off

 T1 Data                Normal
 T1 Clocking            V2PLL
 T1 LBO            CSU  0dB
 T1 Framing             ESF
```

```
T1 Coding             B8ZS
T1 IdleCharacter      0x7f
T1 TxUnderrunAIS      Off
T1 Channels           Full

# copy to here for 4 T1 ports
```

## Example #1: DLT1 Dual 10/100BaseT, Two Active T1 Ports

Scenario:

- with 2 LAN ports and 2 Serial ports
- both serial ports are configured to use LAN1
- serial ports are set to TYPE T1
- no compression or echo cancellation
- SNMP is turned off
- autonegotiation is turned on, (thereby eliminating the need to set duplex and speed parameters)
- Telnet is turned on, (so the administrator can access the IP•Tube unit remotely via the network)
- BroadcastRCV is turned on for both LAN ports
- framing is set to “T1Framed” to coincide with the T1 circuits or CSU/DSU’s that are connected to these ports
- serial ports protocol set to IPTube, (this parameter controls the packetization format)
- Type of Service is set to it’s highest priority, (8)
- Buffers are set to 20 packets and Frames Per Packet are set to 56 on both serial ports (see the *Appendix* for the timing this configuration derives),
- Master clocking is set to Network, (so the unit will derive it’s timing from the T1)
- the T1’s parameters are configured to match the incoming T1’s

### Master Unit:

```
config
Host Contact TestUnit
Host Location TestLab
IP Default 000.000.000.000
Telnet On
UserTimeout Off
snmp off
snmp traps off
```

Interface LAN1

```
Autonegotiation On
IP Address 192.168.1.50/24
#This IP address is the factory default. You will need to enter your IP address
IP Default 000.000.000.000
#No default IP address is needed unless the two units are on different subnets
Port On
BroadcastRcv On
```

## Interface LAN2

```
Autonegotiation On
IP Address 192.168.1.51
IP Default 000.000.000.000
Port Off
BroadcastRcv On
```

## Interface S1

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.52
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Capability Off
Tube Compression Off
Tube 1 Ethernet ARP On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           Network
#Will get timing from the T1 connected to this unit, making this unit the “Master Clocking” unit
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter     0x7f
T1 Channels           Full
```

## Interface S2

```
Type T1
Protocol IPTube
Tube Off
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.52
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           Network
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter     0x7f
```

T1 Channels Full

**Slave Unit:**

config
Host Contact TestSlave
Host Location Remote TestLab2
IP Default 000.000.000.000
Telnet On
User Off
snmp off
snmp traps off

Interface LAN1

Autonegotiation On
IP Address 192.168.1.52/24
IP Default 000.000.000.000
Port On
BroadcastRcv On

Interface LAN2

Autonegotiation On
IP Address 000.000.000.000
#LAN2 is not used on this unit so it needs no IP Address
IP Default 000.000.000.000
Port Off
BroadcastRcv On

Interface S1

Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT 3175
Tube 1 TOS 08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Capability Off
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data Normal
T1 Clocking V2PLL
T1 LBO CSU 0
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 Channels Full

Interface S2

Type T1

```
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           V2PLL
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter      0x7f
T1 Channels           Full
```

Note: In some cases the parameter is noted as a “capability”. This is an indication that the unit was shipped without that particular feature. Contact Engage Sales for upgrades. BroadcastRCV can be turned On and ARP turned Off as long as the IP address is entered as a MAC address.

## Example #2: DLE1 Dual 10/100BaseT, Fractional E1

Scenario:

- with 2 LAN ports and 2 Serial ports
- both serial ports are set to TYPE E1
- no compression or echo cancellation capabilities
- SNMP is turned off,
- autonegotiation is turned on, (thereby eliminating the need to set duplex and speed parameters)
- Telnet is turned on, (so the administrator can access the IP•Tube unit remotely via the network)
- BroadcastRCV is turned on for both LAN ports
- no “looping” is turned on
- the serial ports are set to “Transparent”, framing must be Transparent when using a fractional E1 or T1
- Type of Service is set to it’s highest priority (8),
- Buffers are set to 20 packets and Frames Per Packet are set to 40 on both serial ports (see the appendix for the timing this configuration derives),
- Master clocking is set to network, (so the unit will derive it’s timing from the E1)
- the E1’s are configured to match the incoming E1 circuits

**Master Unit:**

config
Host Contact TestUnit
Host Location TestLab
IP Default 000.000.000.000
Telnet On
User Off
snmp off
snmp traps off

## Interface LAN1

Autonegotiation On
IP Address 192.168.1.50/24
IP Default 192.168.2.50
Port On
BroadcastRcv On

## Interface LAN2

Autonegotiation On
IP Address 192.168.1.51/24
IP Default 192.168.2.50
Port On
BroadcastRcv On

## Interface S1

Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.2.52
Tube 1 UDPPORT 3175
Tube 1 TOS 08
Tube Buffers 20
Tube FPP 40
Tube Duplicates 0
Tube Compression Capability Off
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data Normal
E1 Clocking Network
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 0x7f

| # | | START CHANNEL | NUMBER OF CHANNELS |
|---|---|---|---|
| E1 Channels | Fractional | 1 | 8 |

## Interface S2

Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off

```
Tube Framing Transparent
Tube LANPort LAN1
Tube LANPort LAN2
Tube 1 Destination 192.168.2.52
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 40
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data              Normal
E1 Clocking          Network
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     0x7f
#                          START CHANNEL   NUMBER OF CHANNELS
E1 Channels          Fractional      1            8
```

**Slave Unit:**

```
config
Host Contact TestUnit
Host Location TestPlace
IP Default 198.168.2.50
Telnet On
User Off
snmp off
snmp traps off
```

Interface LAN1

```
Autonegotiation On
IP Address 192.168.2.51
IP Default 192.168.2.50
Port On
BroadcastRcv On
```

Interface LAN2

```
Autonegotiation On
IP Address 192.168.2.51
IP Default 192.168.2.50
Port Off
BroadcastRcv On
```

Interface S1

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 40
```

```
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data              Normal
E1 Clocking          V2PLL
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     0x7f
#                          START CHANNEL   NUMBER OF CHANNELS
E1 Channels          Fractional      1            8
```

Interface S2

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 40
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data              Normal
E1 Clocking          V2PLL
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     0x7f
#                          START CHANNEL   NUMBER OF CHANNELS
E1 Channels          Fractional      1            8
```

## Example #3: DLT1-C Dual LAN Ports, with Compression

Scenario:

- with 2 LAN ports and 2 Serial ports
- both serial ports are configured to use LAN1
- serial port set to TYPE T1
- with Compression
- no echo cancellation
- SNMP is turned off
- autonegotiation is turned on, (thereby eliminating the need to set duplex and speed parameters)
- Telnet is turned on, (so the administrator can access the IP•Tube unit remotely via the network)
- BroadcastRCV is turned on for both LAN ports

- the serial ports are set to “T1Framed” to coincide with the T1 circuits or CSU/DSU’s that are connected to these ports
- Type of Service is set to it’s highest priority, (8)
- Buffers are set to 20 packets and Frames Per Packet are set to 56 on both serial ports (see the *Appendix* for the timing this configuration derives),
- Master clocking is set to network, (so the unit will derive it’s timing from the T1)
- the T1’s parameters are configured to match the incoming Full T1’s

### Master Unit:

```
config
Host Contact TestUnit
Host Location TestLab
IP Default 192.168.1.1
Telnet On
UserTimeout Off
snmp off
snmp traps off
```

Interface LAN1

```
Autonegotiation On
IP Address 192.168.1.50/24
#This IP address is the factory default. You will need to enter your IP address
IP Default 000.000.000.000
#No default IP address is needed unless the two units are on different subnets
Port On
BroadcastRcv On
```

Interface LAN2

```
Autonegotiation On
IP Address 192.168.1.51/24
IP Default 000.000.00.000
Port On
BroadcastRcv On
```

Interface S1

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.52
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Capability On
Tube Compression On
Tube 1 Ethernet ARP On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           Network
```

#Will get timing from the T1 connected to this unit, making this unit the “Master Clocking” unit
T1 LBO CSU 0
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 Channels Full

### Interface S2

Type T1
Protocol IPTube
Tube Off
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.52
Tube 1 UDPPORT 3176
Tube 1 TOS 08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data Normal
T1 Clocking Network
T1 LBO CSU 0
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 Channels Full

## Slave Unit:

config
Host Contact TestSlave
Host Location Remote TestLab2
IP Default 000.000.000.000
Telnet On
User Off
snmp off
snmp traps off

### Interface LAN1

Autonegotiation On
IP Address 192.168.1.52/24
IP Default 000.000.000.000
Port On
BroadcastRcv On

### Interface LAN2

Autonegotiation On
IP Address 000.000.000.000
#LAN2 is not used on this unit so it needs no IP Address
IP Default 000.000.000.000
Port Off
BroadcastRcv On

Interface S1

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Capability On
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           V2PLL
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels           Full
```

Interface S2

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           V2PLL
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels           Full
```

## Example #4: DLT1 Dual LAN Ports, with Echo Cancellation

Scenario:

- with 2 LAN ports and 2 Serial ports
- both serial ports are configured to use LAN1
- serial port set to TYPE T1
- no Compression
- with Echo Cancellation
- SNMP is turned off
- autonegotiation is turned on
- Telnet is turned on
- BroadcastRCV is turned on for both LAN ports
- the serial ports are set to “T1Framed” to coincide with the T1 circuits or CSU/DSU’s that are connected to these ports
- Type of Service is set to it’s highest priority, (8)
- Buffers are set to 20 packets and Frames Per Packet are set to 56 on both serial ports (see the *Appendix* for the timing this configuration derives),
- Master clocking is set to network, (so the unit will derive it’s timing from the T1)
- the T1’s parameters are configured to match the incoming Full T1’s

### Master Unit:

```
config
Host Contact TestUnit
Host Location TestLab
IP Default 192.168.1.1
Telnet On
UserTimeout Off
snmp off
snmp traps off
```

Interface LAN1

```
Autonegotiation On
IP Address 192.168.1.50/24
#This IP address is the factory default. You will need to enter your IP address
IP Default 192.168.1.1
Port On
BroadcastRcv On
```

Interface LAN2

```
Autonegotiation On
IP Address 192.168.1.51
IP Default 000.000.000.000
Port On
BroadcastRcv On
```

Interface S1

```
Type T1
```

```
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.52
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Capability Off
Tube Compression Off
Tube 1 Ethernet ARP On
Tube 1 Ethernet Address 000000000000
T1 Data               Normal
T1 Clocking           Network
#Will get timing from the T1 connected to this unit, making this unit the “Master Clocking” unit
T1 LBO                CSU       0
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter      0x7f
T1 Channels           Full
T1 EchoCanceller      On
T1 Signaling          None
T1 OffEchoChannels    All
```

## Interface S2

```
Type T1
Protocol IPTube
Tube Off
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.52
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data               Normal
T1 Clocking           Network
T1 LBO                CSU       0
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter      0x7f
T1 Channels           Full
T1 EchoCanceller      On
T1 Signaling          None
T1 OffEchoChannels    All
```

**Slave Unit:**

```
config
Host Contact TestSlave
Host Location Remote TestLab2
IP Default 000.000.000.000
Telnet On
User Off
snmp off
snmp traps off
```

Interface LAN1

```
Autonegotiation On
IP Address 192.168.2.52/24
IP Default 192.168.2.1
Port On
BroadcastRcv On
```

Interface LAN2

```
Autonegotiation On
IP Address 000.000.000.000
#LAN2 is not used on this unit so it needs no IP Address
IP Default 000.000.000.000
Port Off
BroadcastRcv On
```

Interface S1

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data               Normal
T1 Clocking           V2PLL
T1 LBO                CSU      0
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter      0x7f
T1 Channels           Full
T1 EchoCanceller      On
T1 Signaling          None
T1 OffEchoChannels    All
```

Interface S2

```
Type T1
Protocol IPTube
```

```
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.50
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           V2PLL
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels           Full
T1 EchoCanceller       On
T1 Signaling         None
T1 OffEchoChannels     All
```

## Example #5: DLT1-C Dual LAN Ports, Two Active T1 Ports, Internal Clocking, with Compression, and Assured Delivery Protocol

Scenario:

- with 2 LAN ports and 2 Serial ports
- both serial ports are configured to use LAN1
- Internal Clocking
- serial port set to TYPE T1
- protocol is set to Assured Delivery, (ADP)
- with Compression
- no Echo Cancellation
- SNMP is turned off
- autonegotiation is turned on
- Telnet is turned on
- BroadcastRCV is turned on for both LAN ports
- the serial ports are set to “T1Framed” to coincide with the T1 circuits or CSU/DSU’s that are connected to these ports
- Type of Service is set to it’s highest priority, (8)
- Buffers are set to 20 packets and Frames Per Packet are set to 56 on both serial ports (see the *Appendix* for the timing this configuration derives),
- Master clocking is set to Internal, (so the unit will derive it’s timing internally)
- the T1’s parameters are configured to match the incoming Full T1’s

**Master Unit:**

```
config
Host Contact Engage
Host Location TubeLab
IP Default 192.168.1.50
Telnet On
User Timeout Off
snmp off
snmp traps off
```

Interface LAN1

```
Auto On
IP Address 192.168.1.51/24
IP Default 000.000.000.000
#default router is set at the system level
Port On
BroadcastRcv On
```

Interface LAN2

```
Auto On
IP Address 192.168.1.52/24
IP Default 000.000.000.000
Port On
BroadcastRcv On
```

Interface S1

```
Type T1
Protocol ADP
Protocol adp delay 5
Protocol adp limit 2
Protocol adp count 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.51
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           Internal
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding            B8ZS
T1 IdleCharacter      0x7F
T1 Channels           Full
```

Interface S2

```
Type T1
```

```
Protocol ADP
Protocol adp delay 5
Protocol adp limit 2
Protocol adp count 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.51
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data               Normal
T1 Clocking            Internal
T1 LBO                CSU       0
T1 Framing             ESF
T1 Coding              B8ZS
T1 IdleCharacter       0x7F
T1 Channels            Full
```

**Slave Unit:**

```
config
Host Contact EngageTube
Host Location TubeLab
IP Default 192.168.2.50
Telnet On
User Off
snmp off
snmp traps off
```

Interface LAN1

```
Autonegotiation On
IP Address 192.168.2.51/24
IP Default 000.000.000.000
#default router is set at the system level
Port On
BroadcastRcv On
```

Interface LAN2

```
Auto On
IP Address 192.168.2.52/24
IP Default 000.000.000.000
Port On
BroadcastRcv On
```

Interface S1

```
Type T1
Protocol adp
Protocol adp delay 5
Protocol adp limit 2
Protocol adp count 1
```

```
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           V2PLL
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding            B8ZS
T1 IdleCharacter       0x7F
T1 Channels           Full
```

Interface S2

```
Type T1
Protocol ADP
Protocol adp delay 5
Protocol adp limit 2
Protocol adp count 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Multi
Tube LANPort LAN2
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
T1 Data              Normal
T1 Clocking           V2PLL
T1 LBO               CSU      0
T1 Framing            ESF
T1 Coding            B8ZS
T1 IdleCharacter       0x7F
T1 Channels           Full
```

## Example #6: GT1 Dual LAN Ports, Four Active Serial Ports

Scenario:

- with 2 LAN ports and 4 Serial ports
- all serial ports are set to TYPE T1

- no compression capabilty
- SNMP is turned off,
- autonegotiation is turned on
- Telnet is turned on, (so the administrator can access the IP•Tube unit remotely via the network),
- BroadcastRCV is turned on for both LAN ports
- ARP is turned on for all 4 serial ports
- the serial ports are set to “T1Framed” to coincide with the T1 circuits or CSU/DSU’s that are connected to these ports
- Full T1’s
- Type of Service is set to it’s highest priority (8),
- Buffers are set to 5 packets and Frames Per Packet are set to 16 on both serial ports (see the appendix for the timing this configuration derives),
- Master clocking is set to network, (so the unit will derive it’s timing from the T1)
- the T1’s are configured to match the incoming T1’s parameters

### Master Unit:

```
config
Host Contact TestTube
Host Location TestLab
IP Default 000.000.000.000
 #default routers set at the interface level
Telnet On
User Timeout Off
snmp off
snmp traps off
```

#### Interface LAN1

```
Auto On
IP Address 192.168.1.51/24
IP Def 192.168.1.50
Port On
BroadcastRcv On
```

#### Interface LAN2

```
Auto On
IP Address 192.168.1.52/24
IP Def 192.168.1.50
Port On
BroadcastRcv On
```

#### Interface S1

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.53
```

```
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Capability Off
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery On
T1 Data              Normal
T1 Clocking          Network
T1 LBO           CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter      0x7f
T1 Channels          Full
```

Interface S2

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN2
Tube 1 Destination 192.168.2.53
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          Network
T1 LBO           CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter      0x7f
T1 Channels          Full
```

Interface S3

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.53
Tube 1 UDPPORT  3177
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
```

```
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          Internal
T1 LBO           CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter      0x7f
T1 Channels          Full
```

### Interface S4

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.53
Tube 1 UDPPORT  3178
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery On
T1 Data              Normal
T1 Clocking          Network
T1 LBO           CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter      0x7f
T1 Channels          Full
```

**Slave Unit:**

```
config
Host Contact Test Tube
Host Location Test Lab
IP Default 000.000.000.000
Telnet On
User Off
snmp off
snmp traps off
```

### Interface LAN1

```
Autonegotiation On
IP Address 192.168.2.53/24
IP Def 192.168.2.50
Port On
BroadcastRcv On
```

### Interface LAN2

```
Autonegotiation On
IP Address 192.168.2.54/24
IP Def 192.168.2.50
Port On
BroadcastRcv On
```

Interface S1

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Capability Off
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          V2PLL
T1 LBO          CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter              0x7f
T1 Channels          Full
```

Interface S2

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN2
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          V2PLL
T1 LBO          CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter              0x7f
T1 Channels          Full
```

Interface S3

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
```

```
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3177
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking           V2PLL
T1 LBO          CSU  0dB
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter              0x7f
T1 Channels           Full
```

Interface S4

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3178
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking           V2PLL
T1 LBO          CSU  0dB
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter              0x7f
T1 Channels           Full
```

## Example #7: GT1 Dual LAN Ports, Four Active Serial Ports with Rate Limiter, Assured Delivery Protocol, Internal Clocking

- with 2 LAN ports and 4 Serial ports
- Rate Limiter is set to 3
- the Spanning Tree protocol is turned off
- Assured Delivery Protocol is being utilized
- all serial ports are set to TYPE T1
- no compression capabilty
- SNMP is turned off,

- autonegotiation is turned on
- Telnet is turned on, (so the administrator can access the IP•Tube unit remotely via the network),
- BroadcastRCV is turned on for both LAN ports
- ARP is turned on for all 4 serial ports
- the serial ports are set to “T1Framed” to coincide with the T1 circuits or CSU/DSU’s that are connected to these ports
- Full T1’s
- Type of Service is set to it’s highest priority (8),
- Buffers are set to 5 packets and Frames Per Packet are set to 16 on both serial ports (see the appendix for the timing this configuration derives),
- Master clocking is set to network, (so the unit will derive it’s timing from the T1)
- the T1’s are configured to match the incoming T1’s parameters

This unit is set up with Engage’s “Rate Limiter” feature which will control the flow of data output of the LAN2 port. You will notice that 2 T1’s are set to output on LAN2 to take advantage of this feature. The Rate Limit parameter is set to 20. In this example Spanning is set to off so that the Spanning Tree Protocol is not used.

### Master Unit:

```
config
Host Contact Test Tube
Host Location Test Lab
IP Default 192.168.1.50
Spanning Off
RateLimit 3
Telnet On
UserTimeout Off
SNMP Off
SNMP Traps Off
```

#### Interface LAN1

```
AutoNegotiation  On
IP Address 192.168.1.51/24
Port On
```

#### Interface LAN2

```
AutoNegotiation  On
IP Address 192.168.1.52/24
Port On
```

#### Interface S1

```
Type T1
Protocol ADPIPTube
Protocol ADPIPTube DelayRetransmit 5
Protocol ADPIPTube LimitRetransmit 2
Protocol ADPIPTube CountRetransmit 1
Tube On
Tube Framing T1
Tube LANPort LAN2
Tube 2 Destination 192.168.2.53
Tube 2 UDPPORT  3175
Tube 2 TOS  08
```

```
Tube 2 Ethernet Arp On
Tube Buffers 20
Tube FPP 16
Tube Compression Off
Tube SequenceRecovery On
T1 Data              Normal
T1 Clocking          Internal
T1 LBO               CSU          0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7F
T1 TxUnderrunAIS     Off
T1 Channels          Full
```

### Interface S2

```
Type T1
Protocol ADPIPTube
Protocol ADPIPTube DelayRetransmit 5
Protocol ADPIPTube LimitRetransmit 2
Protocol ADPIPTube CountRetransmit 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN2
Tube 2 Destination 192.168.2.53
Tube 2 UDPPORT  3176
Tube 2 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 2 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          Internal
T1 LBO           CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels          Full
```

### Interface S3

```
Type E1
Protocol ADPIPTube
Protocol ADPIPTube DelayRetransmit 5
Protocol ADPIPTube LimitRetransmit 2
Protocol ADPIPTube CountRetransmit 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.53
Tube 1 UDPPORT  3177
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
```

```
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          Internal
T1 LBO          CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels          Full
```

Interface S4

```
Type T1
Protocol ADPIPTube DelayRetransmit 5
Protocol ADPIPTube LimitRetransmit 2
Protocol ADPIPTube CountRetransmit 1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.53
Tube 1 UDPPORT  3178
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery On
T1 Data              Normal
T1 Clocking          Internal
T1 LBO          CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels          Full
```

**Slave Unit:**

```
config
Host Contact Test Tube
Host Location Test Lab
IP Default 192.168.2.50
Spanning Off
RateLimit 3
Telnet On
UserTimeout Off
SNMP Off
SNMP Traps Off
```

Interface LAN1

```
Autonegotiation On
IP Address 192.168.2.53/24
IP Def 000.000.000.000
Port On
BroadcastRcv On
```

## Interface LAN2

Autonegotiation On
IP Address 192.168.2.54/24
IP Def 000.000.000.000
Port On
BroadcastRcv On

## Interface S1

Type T1
Protocol ADPIPTube
Protocol ADPIPTube DelayRetransmit 5
Protocol ADPIPTube LimitRetransmit 2
Protocol ADPIPTube CountRetransmit 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 2 Destination 192.168.1.51
Tube 2 UDPPORT 3175
Tube 2 TOS 08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Capability Off
Tube Compression Off
Tube 2 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data Normal
T1 Clocking V2PLL
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 Channels Full

## Interface S2

Type T1
Protocol ADPIPTube
Protocol ADPIPTube DelayRetransmit 5
Protocol ADPIPTube LimitRetransmit 2
Protocol ADPIPTube CountRetransmit 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN2
Tube 2 Destination 192.168.1.51
Tube 2 UDPPORT 3176
Tube 2 TOS 08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 2 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data Normal

```
T1 Clocking          V2PLL
T1 LBO          CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels          Full
```

### Interface S3

```
Type T1
Protocol ADPIPTube
Protocol ADPIPTube DelayRetransmit 5
Protocol ADPIPTube LimitRetransmit 2
Protocol ADPIPTube CountRetransmit 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3177
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          V2PLL
T1 LBO          CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels          Full
```

### Interface S4

```
Type T1
Protocol ADPIPTube
Protocol ADPIPTube DelayRetransmit 5
Protocol ADPIPTube LimitRetransmit 2
Protocol ADPIPTube CountRetransmit 1
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3178
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          V2PLL
T1 LBO          CSU  0dB
```

| | |
|---|---|
| T1 Framing | ESF |
| T1 Coding | B8ZS |
| T1 IdleCharacter | 0x7f |
| T1 Channels | Full |

## Example #8: GE1 Dual LAN Ports, Four Active E1 Ports with Rate Limiter, Internal Clocking

Scenario:

- with 2 LAN ports and 4 Serial ports
- Rate Limiter is set to 3
- the Spanning Tree protocol is turned on
- all serial ports are set to TYPE E1
- no compression capabilty
- SNMP is turned off,
- autonegotiation is turned on
- Telnet is turned on, (so the administrator can access the IP•Tube unit remotely via the network),
- BroadcastRCV is turned on for both LAN ports
- ARP is turned on for all 4 serial ports
- the serial ports are set to “E1Framed” to coincide with the E1 circuits or CSU/DSU’s that are connected to these ports
- Full E1’s
- Type of Service is set to it’s highest priority (8),
- Buffers are set to 5 packets and Frames Per Packet are set to 16 on both serial ports (see the *appendix* for the timing this configuration derives),
- Master clocking is set to Network, (so the unit will derive it’s timing from the E1)
- the E1’s are configured to match the incoming E1’s parameters

This unit is set up with Engage’s “Rate Limiter” feature which will control the output of the LAN2 port. You will notice that 2 serial ports are set to output on LAN2 to take advantage of this feature. The Rate Limit parameter is set to 20. In this example Spanning Tree Protocol is turned on.

### Master Unit:

config
Host Contact Test Tube
Host Location Test Lab
IP Default 000.000.000.000
Spanning On
RateLimit 3
Telnet On
UserTimeout Off
SNMP Off
SNMP Traps Off

Interface LAN1

AutoNegotiation On
IP Address 192.168.1.51/24
IP Def 192.168.1.50
Port On
BroadcastRcv On

### Interface LAN2

AutoNegotiation On
IP Address 192.168.1.52/24
IP Def 192.168.1.50
Port On
BroadcastRcv On

### Interface S1

Type E1
Protocol IPTube
Tube On
Tube Framing E1
Tube LANPort LAN2
Tube 2 Destination 192.168.2.53
Tube 2 UDPPORT 3175
Tube 2 TOS 08
Tube 2 Ethernet Arp On
Tube Buffers 20
Tube FPP 16
Tube Compression Off
Tube SequenceRecovery On
E1 Data Normal
E1 Clocking Internal
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 0x7F
E1 Channels Full

### Interface S2

Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN2
Tube 2 Destination 192.168.2.53
Tube 2 UDPPORT 3176
Tube 2 TOS 08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 2 Ethernet Arp On
Tube SequenceRecovery Off
E1 Data Normal
E1 Clocking Internal
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 0x7F
E1 Channels Full

Interface S3

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.53
Tube 1 UDPPORT  3177
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
E1 Data              Normal
E1 Clocking          Internal
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     0x7F
E1 Channels          Full
```

Interface S4

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.2.53
Tube 1 UDPPORT  3178
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 2 Ethernet Arp On
Tube SequenceRecovery On
E1 Data              Normal
E1 Clocking          Internal
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     0x7F
E1 Channels          Full
```

**Slave Unit:**

```
config
Host Contact Test Tube
Host Location Test Lab
IP Default 000.000.000.000
Spanning On
RateLimit 3
Telnet On
User Off
```

snmp off
snmp traps off

## Interface LAN1

Autonegotiation On
IP Address 192.168.1.53/24
IP Def 192.168.2.50
Port On
BroadcastRcv On

## Interface LAN2

Autonegotiation On
IP Address 192.168.1.54/24
IP Def 192.168.2.50
Port On
BroadcastRcv On

## Interface S1

Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 2 Destination 192.168.1.51
Tube 2 UDPPORT 3175
Tube 2 TOS 08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Capability Off
Tube Compression Off
Tube 2 Ethernet Arp On
Tube SequenceRecovery Off
E1 Data Normal
E1 Clocking Internal
E1 Framing CRC4
E1 Coding HDB3
E1 IdleCharacter 0x7F
E1 Channels Full

## Interface S2

Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN2
Tube 2 Destination 192.168.1.51
Tube 2 UDPPORT 3176
Tube 2 TOS 08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off

```
Tube 2 Ethernet Arp On
Tube SequenceRecovery Off
E1 Data              Normal
E1 Clocking          Internal
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     0x7F
E1 Channels          Full
```

### Interface S3

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3177
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
E1 Data              Normal
E1 Clocking          Internal
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     0x7F
E1 Channels          Full
```

### Interface S4

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.52
Tube 1 UDPPORT  3178
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Off
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
E1 Data              Normal
E1 Clocking          Internal
E1 Framing           CRC4
E1 Coding            HDB3
E1 IdleCharacter     0x7F
E1 Channels          Full
```

# Example #9: GE1 Dual 10/100BaseT, Fractional E’1s, Network Clocking

Scenario:

- with 2 LAN ports and 4 Serial ports
- serial ports are set to TYPE E1
- this system is using Fractional E1’s
- SNMP is turned off
- autonegotiation is turned on, (thereby eliminating the need to set duplex and speed parameters),
- Telnet is turned on, (so the administrator can access the IP•Tube unit remotely via the network),
- BroadcastRCV is turned on for both LAN ports
- the serial ports are set to “E1Framed” to coincide with the E1 circuits or CSU/DSU’s that are connected to these ports,
- Type of Service is set to it’s highest priority (8),
- Buffers are set to 20 packets and Frames Per Packet are set to 56 on both serial ports (see the appendix for the timing this configuration derives),
- Master clocking is set to Network, (so the unit will derive it’s timing from the E1)
- the E1’s are configured to match the incoming E1’s

### Master Unit:

config
Host Contact TestUnit
Host Location TestPlace
IP Default 000.000.000.000
Telnet On
UserTimeout Off
snmp off
snmp traps off

Interface LAN1

Autonegotiation On
IP Address 192.168.1.51/24
IP Default 192.168.2.50
Port On
BroadcastRcv On

Interface LAN2

Autonegotiation On
IP Address 000.000.000.000
IP Default 000.000.000.000
Port Off
BroadcastRcv On

Interface S1

Type E1
Protocol IPTube
Tube On

```
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
#Framing must be set to “Transparent” when using fractional E1’s
Tube LANPort LAN1
Tube 1 Destination 192.168.2.52
Tube 1 UDPPORT  3175
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data               Normal
E1 Clocking           Network
E1 LBO            CSU  0dB
E1 Framing            ESF
E1 Coding             B8ZS
E1 IdleCharacter      0x7f
E1 Channels           Fractional 1 8, 16 - 24
#This config will include 8 channels starting with channel 1 and 16 thru 24
```

### Interface S2

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.2.52
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data               Normal
E1 Clocking           Network
E1 LBO            CSU  0dB
E1 Framing            ESF
E1 Coding             B8ZS
E1 IdleCharacter      0x7f
E1 Channels           Fractional 1 8, 16 - 24
```

### Interface S3

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
```

```
Tube 1 Destination 192.168.2.52
Tube 1 UDPPORT  3177
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data               Normal
E1 Clocking           Network
E1 LBO            CSU  0dB
E1 Framing            ESF
E1 Coding             B8ZS
E1 IdleCharacter      0x7f
E1 Channels           Fractional 1 8, 16 - 18, 24
#This config will include 8 channels starting with channel 1, plus channels 16 thru 18, and channel 24
```

Interface S4

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing Transparent
Tube LANPort LAN1
Tube 1 Destination 192.168.1.52
Tube 1 UDPPORT  3178
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data               Normal
E1 Clocking           Network
E1 LBO            CSU  0dB
E1 Framing            ESF
E1 Coding             B8ZS
E1 IdleCharacter      0x7f
E1 Channels           Fractional 1 8, 16 - 18, 24
```

**Slave Unit:**

```
config
Host Contact TestUnit
Host Location RemoteTestPlace
IP Default 192.168.2.50
Telnet On
UserTimeout Off
snmp off
snmp traps off
```

Interface LAN1

```
Autonegotiation On
IP Address 192.168.2.52/24
IP Default 192.168.2.50
```

Port On
BroadcastRcv On

## Interface LAN2

Autonegotiation On
IP Address 192.168.2.53
IP Default 192.168.2.50
Port Off
BroadcastRcv On

## Interface S1

Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3175
Tube 1 TOS 08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data Normal
E1 Clocking V2PLL
E1 LBO CSU 0dB
E1 Framing ESF
E1 Coding B8ZS
E1 IdleCharacter 0x7f
E1 Channels Fractional 1 8, 16 - 24
#This config will include 8 channels starting with channel 1 and 16 thru 24

## Interface S2

Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3176
Tube 1 TOS 08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data Normal
E1 Clocking V2PLL
E1 LBO CSU 0dB
E1 Framing ESF

```
E1 Coding            B8ZS
E1 IdleCharacter      0x7f
E1 Channels           Fractional 1 8, 16 - 24
```

### Interface S3

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3177
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data              Normal
E1 Clocking          V2PLL
E1 LBO           CSU  0dB
E1 Framing           ESF
E1 Coding            B8ZS
E1 IdleCharacter      0x7f
E1 Channels           Fractional 1 8, 16 - 18, 24
#This config will include 8 channels starting with channel 1, plus channels 16 thru 18, and channel 24
```

### Interface S4

```
Type E1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing E1Framed
Tube LANPort LAN1
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3178
Tube 1 TOS  08
Tube Buffers 20
Tube FPP 56
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
E1 Data              Normal
E1 Clocking          V2PLL
E1 LBO           CSU  0dB
E1 Framing           ESF
E1 Coding            B8ZS
E1 IdleCharacter      0x7f
E1 Channels           Fractional 1 8, 16 - 18, 24
```

# Example #10: DLT1 Dual LAN Ports, Two Active Serial Ports with Compression and Echo Cancellation and Assured Delivery Protocol

Scenario:

- with 2 LAN ports and 2 Serial ports
- all serial ports are set to TYPE T1
- compression and echo cancellation are enabled
- SNMP is turned off
- autonegotiation is turned on
- Telnet is turned on
- BroadcastRCV is turned on for both LAN ports
- ARP is turned on for both serial ports
- the serial ports are set to “T1Framed” to coincide with the T1 circuits or CSU/DSU’s that are connected to these ports
- Type of Service is set to it’s highest priority (8),
- Buffers are set to 5 packets and Frames Per Packet are set to 16 on both serial ports (see the appendix for the timing this configuration derives),
- Master clocking is set to Network, (so the unit will derive it’s timing from the T1 circuit)
- the T1’s are configured to match the incoming T1’s parameters

### Master Unit:

config
Host Contact TestTube
Host Location Test Environment
IP Default 192.168.1.50
Telnet On
User Off
snmp off
snmp traps off

Interface LAN1

Auto On
IP Address 192.168.1.51/24
IP Def
Port On
BroadcastRcv On

Interface LAN2

Auto On
IP Address 192.168.1.52/24
IP Def
Port On
BroadcastRcv On

Interface S1

Type T1
Protocol IPTube

```
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN2
Tube 2 Destination 192.168.2.53
Tube 2 UDPPORT  3175
Tube 2 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Capability On
Tube Compression On
Tube 2 Ethernet Arp On
Tube SequenceRecovery On
T1 Data              Normal
T1 Clocking          Network
T1 LBO           CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels          Full
T1 EchoCanceller     On
T1 Signaling         None
T1 OffEchoChannels   All
```

Interface S2

```
Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN2
Tube 2 Destination 192.168.2.53
Tube 2 UDPPORT  3176
Tube 2 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression On
Tube 2 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data              Normal
T1 Clocking          Network
T1 LBO           CSU  0dB
T1 Framing           ESF
T1 Coding            B8ZS
T1 IdleCharacter     0x7f
T1 Channels          Full
T1 EchoCanceller     On
T1 Signaling         None
T1 OffEchoChannels   All
```

**Slave Unit:**

```
config
Host Contact TestTube
Host Location Test Environment
```

IP Default 192.168.2.50
Telnet On
User Off
snmp off
snmp traps off

## Interface LAN1

Auto On
IP Address 192.168.1.51/24
IP Def
Port On
BroadcastRcv On

## Interface LAN2

Auto On
IP Address 192.168.1.52/24
IP Def
Port On
BroadcastRcv On

## Interface S1

Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN2
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3175
Tube 1 TOS 08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression Capability On
Tube Compression On
Tube 1 Ethernet Arp On
Tube SequenceRecovery On
T1 Data Normal
T1 Clocking V2PLL
T1 LBO CSU 0dB
T1 Framing ESF
T1 Coding B8ZS
T1 IdleCharacter 0x7f
T1 Channels Full
T1 EchoCanceller On
T1 Signaling None
T1 OffEchoChannels All

## Interface S2

Type T1
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube Framing T1Framed
Tube LANPort LAN1

```
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT  3176
Tube 1 TOS  08
Tube Buffers 5
Tube FPP 16
Tube Duplicates 0
Tube Compression On
Tube 1 Ethernet Arp On
Tube SequenceRecovery Off
T1 Data               Normal
T1 Clocking           V2PLL
T1 LBO           CSU  0dB
T1 Framing            ESF
T1 Coding             B8ZS
T1 IdleCharacter      0x7f
T1 Channels           Full
T1 EchoCanceller      On
T1 Signaling          None
T1 OffEchoChannels    All
```

## Example #11: IP•Tube RS530 Video

IP•Tube RS530/V.35 configurations are detailed in this section. The command line configuration listing is shown for each example. The configuration commands are defined in Chapter 5: Command Line Interface as well as in a detailed discussion provided in Chapter 7: *IP•TubeRS530/V35 Configuration & Operation.*

### Scenario

This sample configuration details the interconnection of a synchronous serial Video Encoder to a Video Decoder via IP•Tube RS530's that are providing smooth clocking at a rate of 1.536 Megabits per second. The IP•Tube's Ethernet interconnection has a committed information rate that is much greater than the IP•Tube's maximum data rate. Therefore the Ethernet bandwidth available is relatively unlimited.

The Tube Clock on one of the IP•Tube RS530's need to be set to Internal and the other to **PLL**. The **SCRCLOCK** will be set to run at the same speed as the **SCTCLOCK** without gapping so that buffering of packets is required and the Frames Per Packet is set to the maximum for maximum efficiency.

For this example, the user will select Frames-Per-Packet = 20. With this **TUBE FPP** setting, the Overhead Table in Chapter 6 indicates an approximate 3.4% (ratio is 1.034) overhead. IP•Tube Ethernet Data rate is 1.034 times 1.536 Mbps.

**Command Line Listing**

```
Host Name IPTube-530
IP Default-router
Interface E1
# IP Address of this IP•Tube
IP Address 192.168.1.1/24
Interface S1
Type RS-530
SCR Normal
SCT Normal
Protocol IPTube
Tube On
# IP Address of the Remote IP•Tube
Tube Address 192.168.1.2
Tube TOS 0x08
Tube FPP 16
```

Tube Clock Internal
Tube SCRCLOCK MODE NX64K
Tube SCRCLOCK FACTOR 24
Tube SCTCLOCK MODE NX64K
Tube SCTCLOCK FACTOR 24
Tube Buffer 10
Tube Interval 0
Tube Percentage 100

## Example #12: IP•Tube V.35 HDLC

### Scenario

This sample configuration details the interconnection of a WAN Routers running Point to Point Protocol via IP•TubeV.35s that are providing smooth clocking at a rate of 128 Kilobits per second. The IPTube's Ethernet interconnection has a committed information rate that is much greater than the IPTube's maximum data rate. Therefore the Ethernet bandwidth available is relatively unlimited.

The Tube Clocks on one of the IP•Tube V35s are both set to Internal. The **SCRCLOCK** will be set to run at the same speed as the **SCTCLOCK** without gapping. Buffering of packets is not required and the Frames Per Packet is set low minimize latency.

For this example, the user will select Frames-Per-Packet = 2. With this **TUBE FPP** setting, the Overhead Table in Chapter 6 indicates an approximate 34% (ratio is 1.34) overhead. IP•Tube Ethernet Data rate is 1.34 times 128Kbps which equals 171.52 Kilobits per second.

**Command Line Listing**

Host Name IPTube-V.35
IP Default-router
Interface E1
# IP Address of this IP•Tube
IP Address 192.168.1.1/24
Interface S1
Type V35
SCR Normal
SCT Normal
Protocol HDLCoIP
Tube On
# IP Address of the Remote IP•Tube
Tube Address 192.168.1.2
Tube TOS 0x08
Tube FPP 2
Tube Clock Internal
Tube SCRCLOCK MODE NX64K
Tube SCRCLOCK FACTOR 2
Tube SCTCLOCK MODE NX64K
Tube SCTCLOCK FACTOR 2
Tube Buffer 10
Tube Interval 0
Tube Percentage 100

# Example #13: IP•Tube SER RS530

## Master Unit

```
# Config for IP Tube SER RS530 DCE Internal Clocking

int
co

Host Contact “No contact specified”
Host Location “No location specified”


OurDNSServer

IP Default-router 255.255.255.255


Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

SSHD Off

Interface LAN1
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.1.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 DDNS Off
 OurDomainName

Interface LAN2
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.2.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 DDNS Off
 OurDomainName

Interface S1
 Type RS-530
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
```

```
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 32
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 32
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 1024
 Tube Duplicates 0


Interface S2
 Type RS-530
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 32
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 32
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3176
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 1024
 Tube Duplicates 0


Interface S3
 Type RS-530
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
```

```
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 32
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 32
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.50
 Tube 2 UDPPORT  3277
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 1024
 Tube Duplicates 0


Interface S4
 Type RS-530
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 32
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 32
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.50
 Tube 2 UDPPORT  3278
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 1024
 Tube Duplicates 0
```

### Slave Unit

```
# Config for IP Tube SER RS530 DCE PLL Clocking
```

```
int
co

Host Contact “No contact specified”
Host Location “No location specified”


OurDNSServer

IP Default-router 255.255.255.255


Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

SSHD Off

Interface LAN1
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.1.50/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface LAN2
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.2.50/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface S1
 Type RS-530
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 32
```

```
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 32
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3175
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 1024
 Tube Duplicates 0


Interface S2
 Type RS-530
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 32
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 32
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3176
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 1024
 Tube Duplicates 0


Interface S3
 Type RS-530
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
```

```
Tube SCRClock Mode NX64k
Tube SCRClock Factor 32
Tube SCTClock Mode NX64k
Tube SCTClock Factor 32
Tube RemoteClockConfig Off
Tube Localloop Off
Tube Remoteloop Off
Tube LANPort LAN2
Tube 2 DynamicAddress Off
Tube 2 Destination 192.168.2.51
Tube 2 UDPPORT  3277
Tube 2 TOS  0xB8
Tube 2 Ethernet Arp On
Tube 2 Ethernet Address 000000000000
Tube Overflow 3
Tube Buffers 5
Tube BytesPerPacket 1024
Tube Duplicates 0


Interface S4
 Type RS-530
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 32
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 32
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.51
 Tube 2 UDPPORT  3278
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 1024
 Tube Duplicates 0
```

## Example #14:  IP•Tube SER RS2323

### Master Unit

```
# Config for IP Tube SER RS530 DCE Internal Clocking

int
co
```

```
Host Contact “No contact specified”
Host Location “No location specified”


OurDNSServer

IP Default-router 255.255.255.255


Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

SSHD Off

Interface LAN1
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.1.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 DDNS Off
 OurDomainName

Interface LAN2
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.2.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 DDNS Off
 OurDomainName

Interface S1
 Type RS-232
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
```

```
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S2
 Type RS-232
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3176
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S3
 Type RS-232
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
```

```
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.50
 Tube 2 UDPPORT  3277
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S4
 Type RS-232
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.50
 Tube 2 UDPPORT  3278
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0
```

## Slave Unit

```
# Config for IP Tube SER RS232 DCE PLL Clocking

int
co

Host Contact “No contact specified”
Host Location “No location specified”


OurDNSServer
```

```
IP Default-router 255.255.255.255


Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

SSHD Off

Interface LAN1
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.1.50/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface LAN2
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.2.50/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface S1
 Type RS-232
 Mode  Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3175
```

```
 Tube 1 TOS  0x08
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S2
 Type RS-232
 Mode  Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3176
 Tube 1 TOS  0x08
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S3
 Type RS-232
 Mode  Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
```

Tube 2 Destination 192.168.2.51
Tube 2 UDPPORT 3277
Tube 2 TOS 0x08
Tube 2 Ethernet Arp On
Tube 2 Ethernet Address 000000000000
Tube Overflow 3
Tube Buffers 5
Tube BytesPerPacket 160
Tube Duplicates 0

Interface S4
Type RS-232
Mode Synchronous
SCR Normal
SCT Normal
DCEDTEMode DCE
Protocol IPTube
Tube Name
Tube On
Tube Clock PLL
Tube TermTiming Off
Tube SCRClock Mode NX64k
Tube SCRClock Factor 1
Tube SCTClock Mode NX64k
Tube SCTClock Factor 1
Tube RemoteClockConfig Off
Tube Localloop Off
Tube Remoteloop Off
Tube LANPort LAN2
Tube 2 DynamicAddress Off
Tube 2 Destination 192.168.2.51
Tube 2 UDPPORT 3278
Tube 2 TOS 0x08
Tube 2 Ethernet Arp On
Tube 2 Ethernet Address 000000000000
Tube Overflow 3
Tube Buffers 5
Tube BytesPerPacket 160
Tube Duplicates 0

## Example #15: IP•Tube SER V.35

### Master Unit

# Config for IP Tube SER RS530 DCE Internal Clocking

int
co

Host Contact “No contact specified”
Host Location “No location specified”

OurDNSServer

IP Default-router 255.255.255.255

```
Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

SSHD Off

Interface LAN1
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.1.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 DDNS Off
 OurDomainName

Interface LAN2
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.2.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 DDNS Off
 OurDomainName

Interface S1
 Type V.35
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
```

```
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S2
 Type V.35
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3176
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S3
 Type V.35
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.50
 Tube 2 UDPPORT  3277
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
```

```
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S4
 Type V.35
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock Internal
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.50
 Tube 2 UDPPORT  3278
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0
```

## Slave Unit

```
# Config for IP Tube SER RS530 DCE PLL Clocking

int
co

Host Contact “No contact specified”
Host Location “No location specified”


OurDNSServer

IP Default-router 255.255.255.255


Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off
```

```
SSHD Off

Interface LAN1
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.1.50/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface LAN2
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.2.50/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface S1
 Type V.35
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3175
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0
```

```
Interface S2
 Type V.35
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3176
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0


Interface S3
 Type V.35
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.51
 Tube 2 UDPPORT  3277
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0
```

```
Interface S4
 Type V.35
 Mode Synchronous
 SCR  Normal
 SCT  Normal
 DCEDTEMode  DCE
 Protocol IPTube
 Tube Name
 Tube On
 Tube Clock PLL
 Tube TermTiming Off
 Tube SCRClock Mode NX64k
 Tube SCRClock Factor 1
 Tube SCTClock Mode NX64k
 Tube SCTClock Factor 1
 Tube RemoteClockConfig Off
 Tube Localloop Off
 Tube Remoteloop Off
 Tube LANPort LAN2
 Tube 2 DynamicAddress Off
 Tube 2 Destination 192.168.2.51
 Tube 2 UDPPORT  3278
 Tube 2 TOS  0xB8
 Tube 2 Ethernet Arp On
 Tube 2 Ethernet Address 000000000000
 Tube Overflow 3
 Tube Buffers 5
 Tube BytesPerPacket 160
 Tube Duplicates 0
```

## Legacy Configurations Examples

The following examples are for earlier versions of the IP•Tube models for those that have purchased Engage Products in the past, yet in many cases they apply to current products. They also provide a wider selection of various configuration options. If none of the above examples fit your particular situation, look for a more appropriate sampling in the examples below.

IP•Tube T1 and E1 for models DL and G configurations are detailed in this section. Examples of typical RS530 and V.35 confgurations are also listed. The command line configuration listing is shown for each example. The configuration commands are defined in Chapter 5: *Command Line Interface* as well as in a detailed discussion provided in Chapters 6 and 7: *Configuration & Operation*.

## Example #1: IP•Tube DLT1 Full 24 DS0s with T1 Framing Bits

### Scenario

This sample configuration details an IP•Tube interconnect of a Full T1 with framing bits. Note that the IP•Tube adds overhead in its conversion of T1 to IP packets so that the full T1 frame rate of 1.544 Mbps requires 1.906 Mbps of interconnect bandwidth on the ethernet side. See *Chapter 5: Configuration and Operation* for a complete description of the overhead associated with encapsualtion of T1/E1 frames into IP packets.

**Command Line Listing**

```
HostName IPTube T1
IP Default-router
Interface E1
# IP Address of this IP•Tube:
IP Address 192.168.1.1/24
# Ethernet Broadcast/Multicast Reception Control
BroadcastRCV ON
Interface S1
Type T1
# Tube Parameters
Protocol IPTube
Tube On
Tube Framing T1Framed
#    IP Address of remote IP•Tube:
Tube Address 192.168.1.2
# Tube Destination Ethernet Address Resolution
Tube TOS 08 Hex
TubeUDPPORT 3175
Tube Buffers  5
Tube FPP 8
Tube Compression Off
Tube Ethernet Arp On
Tube Ethernet Address
# T1 Parameters
T1 Data          Normal
#     T1 Transmit timing set to Phase Lock Loop:
T1 Clocking      V2PLL
T1 LBO           CSU          0dB
T1 Framing       ESF
T1 Coding        B8ZS
T1 IdleCharacter 0x7F
T1 Channels      Full
```

## Example #2: IP•TubeDLT1 Fractional T1: 8 DS0s without T1 Framing Bits

### Scenario

This sample configuration details an IP•Tube interconnect of a fractional T1 without framing bits. DS0 1 through 8 are transported. This IP•Tube is set to internal timing as the master clock of the IP•Tube's T1 connection. The remote IP•Tube must be set to use its Phase Lock Loop to match this frequency. Note: the remote IP•Tube is across a WAN whose IP address range is 192.168.2.x. The WAN router address is 192.168.1.4 this is the address for the Default Router.

**Command Line Listing**

```
Host Name IP•Tube-T1 Master Clock
IP Default-router 192.168.1.4
Interface E1
# IP Address of this IP•Tube
IP Address 192.168.1.1/24
# Ethernet Broadcast/Multicast Reception Control
BroadcastRCV ON
Interface S1
Type T1
# Tube Parameters
Protocol IPTube
Tube On
Tube Framing Transparent
```

```
# IP Address of remote IP•Tube
Tube Address 192.168.2.1
Tube UDPPort 3175
Tube TOS 0x08
Tube Buffers   5
Tube FPP   8
# Tube Destination Ethernet Address Resolution
Tube Ethernet ARP On
Tube Ethernet Address
# T1 Parameters
T1 Data          Normal
# T1 Transmit timing set to Internal
T1 Clocking      Internal
T1 LBO           CSU          0dB
T1 Framing       ESF
T1 Coding        B8ZS
T1 IdleCharacter 0x7F
#                             START CHANNEL   NUMBER OF CHANNELS
T1 Channels      Fractional       1             8, 12-14, 18-24
```

Note: When more then one group of channels, not contigous, hyphens and commas can be used to list all group, or individual channels.

## Example #3: IP•Tube T1 Compression: 24 DS0s with 56 to 1 Compression

### Scenario

This sample configuration details an IP•Tube interconnect of a Full T1 with compression enabled. Note: For the IP•Tube DL and G models T1 compression must be without framing bits. DS0 1 through 24 are transported. This IP•Tube is set to internal timing as the master clock of the IP•Tube's T1 connection. The remote IP•Tube must be set to use its Phase Lock Loop to match this frequency. Note: the remote IP•Tube is across a WAN whose IP address range is 192.168.2.x. The WAN router address is 192.168.1.4. This is the address for the Default Router.

**Command Line Listing**

```
Host Name IP•Tube-T1 Compression Master Clock
IP Default-router 192.168.1.4
Interface E1
# IP Address of this IP•Tube
IP Address 192.168.1.1/24
# Ethernet Broadcast/Multicast Reception Control
BroadcastRCV ON
Interface S1
Type T1
# Tube Parameters
Protocol IPTube
Tube On
Tube Framing Transparent
# IP Address of remote IP•Tube
Tube Address 192.168.2.1
Tube TOS 0x08
Tube Buffers   10
# Note: Echo Cancellation Required
Tube FPP   56
Tube Compression ON
# Tube Destination Ethernet Address Resolution
Tube Ethernet ARP ON
Tube Ethernet Address
# T1 Parameters
```

```
T1 Data         Normal
# T1 Transmit timing set to Internal
T1 Clocking     Internal
T1 LBO          CSU          0dB
T1 Framing      ESF
T1 Coding       B8ZS
T1 IdleCharacter 0x7F
T1 Channels     Full
```

## Example #4: IP•Tube-E1 Full 31 DS0s with E1 Framing Byte

### Scenario

This sample configuration details an IP•Tube-E1 interconnect of a full E1 with framing bits. All 31 DS0s are transported. Note: the IP•Tube adds overhead in its conversion of E1 to IP packets so that the full E1 frame rate of 2,048,000 requires 2,250,000 bits per second of interconnect bandwidth.

**Command Line Listing**

```
Host Name IP Tube E1
IP Default-router
IP Cost 1
Interface E1
# IP Address of this IP•Tube
IP Address 192.168.1.1/24
# Ethernet Broadcast/Multicast Reception Control
BroadcastRCV ON
Interface S1
Type E1
# Tube Parameters
Protocol IP•Tube
Tube On
Tube Framing E1Framed
# IP Address of Remote IP•Tube
Tube Address 192.168.1.2
Tube UDPPort 3175
Tube TOS 08 Hex
Tube Buffers 5
Tube FPP 12
Tube Compression Off
# Tube Destination Ethernet Address Resolution
Tube Ethernet ARP On
Tube Ethernet Address
# E1 Interface Configuration Parameters
E1 Data         Normal
# E1 Transmit timing set to Phase Lock Loop
E1 Clocking     V2PLL
E1 Framing      CRC4
E1 Coding       HDB3
E1 IdleCharacter 0x7F
E1 Channels     Full
```

## Example #5: IP•Tube Fractional E1: 8 DS0s without E1 Framing Byte

### Scenario

This sample configuration details an IP•Tube interconnect of a fractional E1 without framing byte. E1 framing is generated locally. DS0 1 through 8 are transported. This IP•Tube is set to internal timing as the master clock of the IP•Tube's E1 connection. The remote IP•Tube must be set to use its Phase Lock Loop to match this frequency.
Note: the remote IP•Tube is across a WAN whose IP address range is 192.168.2.x. The WAN router address is 192.168.1.4 and is the address for the Default Router.

**Command Line Listing**

```
Host Name IPTube E1 Master Clock
IP Default-router 192.168.1.4
Interface E1
# IP Address of this IP•Tube
IP Address 192.168.1.1/24
Interface S1
Type T1
Protocol IPTube
Tube On
Tube Framing Transparent
# IP Address of remote IP•Tube
Tube Address 192.168.1.2
Tube UDPPort 3175
Tube TOS 08 Hex
Tube Buffers 5
Tube FPP 12
Tube Compression Off
# Tube Destination Ethernet Address Resolution
Tube Ethernet ARP On
Tube Ethernet Address
E1 Data          Normal
# E1 Transmit timing set to Internal
E1 Clocking      Internal
E1 Framing       CRC4
E1 Coding        HDB3
E1 IdleCharacter 0x7F
#                          START CHANNEL   NUMBER OF CHANNELS
E1 Channels      Fractional       1              8
```

## Example #6: IP•Tube E1 Compression: 32 DS0s with 40 to 1 Compression

### Scenario

This sample configuration details an IP•Tube interconnect of a Full E1 with compression enabled. Note: E1 compression does not need to be without framing bits. DS0 1 through 32 are transported. This IP•Tube is set to internal timing as the master clock of the IP•Tube's T1 connection. The remote IP•Tube must be set to use its Phase Lock Loop to match this frequency. Note: the remote IP•Tube is across a WAN whose IP address range is 192.168.2.x. The WAN router address is 192.168.1.4 this is the address for the Default Router.

**Command Line Listing**

```
Host Name IP•Tube-T1 Compression Master Clock
IP Default-router 192.168.1.4
Interface E1
# IP Address of this IP•Tube
IP Address 192.168.1.1/24
# Ethernet Broadcast/Multicast Reception Control
```

```
BroadcastRCV ON
Interface S1
Type E1
# Tube Parameters
Protocol IPTube
Tube On
Tube Framing Transparent
# IP Address of remote IP•Tube
Tube Address 192.168.2.1
Tube TOS 0x08
Tube Buffers   10
# Note Echo Cancellation Required
Tube FPP   40
Tube Compression ON
# Tube Destination Ethernet Address Resolution
Tube Ethernet ARP ON
Tube Ethernet Address
# E1 Parameters
E1 Data          Normal
# E1 Transmit timing set to Internal
E1 Clocking      Internal
E1 Framing       CRC4
E1 Coding        HDB3
E1 IdleCharacter 0x7F
E1 Channels      Full
```

## Example #7: IP•Tube RS530 Video

IP•Tube RS530/V.35 configurations are detailed in this section. The command line configuration listing are shown for each example. The configuration commands are defined in Chapter 5: Command Line Interface as well as in a detailed discussion provided in *Chapter 7: IP•TubeRS530/V35 Configuration & Operation.*

### Scenario

This sample configuration details the interconnection of a synchronous serial Video Encoder to a Video Decoder via IP•TubeRS530s that are providing smooth clocking at a rate of 1.536 Megabits per second. The IP•Tube's Ethernet interconnection has a committed information rate that is much greater than the IP•Tube's maximum data rate. Therefore the Ethernet bandwidth available is relatively unlimited.

The Tube Clock on one of the IP•TubeRS530s need to be set to Internal and the other to **PLL**. The **SCR-CLOCK** will be set to run at the same speed as the **SCTCLOCK** without gapping so that buffering of packets is required and the Frames Per Packet is set to the maximum for maximum efficiency.

For this example, the user will select Frames-Per-Packet = 20. With this **TUBE FPP** setting, the Overhead Table in Chapter 6 indicates an approximate 3.4% (ratio is 1.034) overhead. IP•Tube Ethernet Data rate is 1.034 times 1.536 Mbps.

**Command Line Listing**

```
Host Name IPTube-530
IP Default-router
Interface E1
# IP Address of this IP•Tube
 IP Address 192.168.1.1/24
Interface S1
Type RS-530
SCR Normal
SCT Normal
Protocol IPTube
Tube On
```

```
# IP Address of the Remote IP•Tube
Tube Address 192.168.1.2
Tube TOS 0x08
Tube FPP 20
Tube Clock Internal
Tube SCRCLOCK MODE NX64K
Tube SCRCLOCK FACTOR 24
Tube SCTCLOCK MODE NX64K
Tube SCTCLOCK FACTOR 24
Tube Buffer 10
Tube Interval 0
Tube Percentage 100
```

# Chapter 5

# Command Line Interface

The IP•Tube Command Line can be accessed with a serial connection to the Console port or a Telnet connection via the Ethernet interface.

For communication through the Console port, almost any standard terminal communication software can be used such as Hyperterm or Teraterm. The console port can be utlized to communicate with the IP•Tube locally, through a terminal, or remotely by dialing in through a modem.

Telnet, part of the TCP/IP Protocol Suite, provides a general communications facility defining a standard method of interfacing terminal devices to each other. Any standard Telnet application can be used to communicate to an Engage IP•Tube provided there is IP connectivity between the User Host and the IPTube.

## Console Communication

Serial communication to the console port should be configured for,

**9600 baud, 1 stop bit, no parity, 8 bit data, flow control none**.

The console port is an RJ45 jack and an appropriate cable and adapter are provided with the IP•Tube for use with standard 9 pin COM ports. The RJ45 console port is configured as a DCE, (data communication equipment), port.

Upon connecting enter a **<cr>** and a **LOGIN** prompt will appear.

The default **Login** ID is **root**.

No password is needed until the user sets it with the **PASSWD** command.

### Logging in to the IP•Tube

A Telnet session is opened by providing the IP address of the IP•Tube. On opening a Command Line Interface, (CLI), session, via Telnet or the Console port, the **Login** prompt requires entry of a login ID.

The default login ID: **root.**

The IP•Tube is shipped with no password set. Passwords are set or modified with the **passwd** command, detailed below.

### Overview of Commands

The Engage CLI supports shorthand character entry. At most, 3 characters are required for the parsing of the commands. For example, **show configuration** can be entered as: **sh con**. The CLI is not case senstive. Description of the commands uses both upper and lower case for syntax definitions and examples.

A full description of the command line interface follows.

### Categories

The command set can be divided into four categories:

- General
- Show
- Config
- Config Interface

## Online Help

Included in the General commands is the HELP command, providing information on the entire command set. The Help command can be used in or out of the configuration modes.

## Configuration Modes

For the Config and Config Interface commands, Engage employs a model approach. The user enters the Config mode with the **CONFIG** command, makes changes, then **SAVE**s those changes. END enables you to exit the config mode.

The Config Interface mode, within the Config mode, is used to set parameters for a specified interface. Once in the Configuration mode, the user enters the **INTERFACE** command specifying the port that is to be configured. All subsequent commands apply to the specified interface.

Example:

name## **INTERFACE S1**

The command prompt indicates the mode of operation:

name# the single "#" indicates standard Telnet mode

name## indicates the IP•Tube is in the Config mode

name(LAN1)## IP•Tube is in Config Interface mode for LAN Port 1

To move up one level, from Interface Config mode to Config mode, enter the **INTERFACE** command with no argument. To change between interfaces when in Interface Config mode, specify the new interface. For example:

name(s1)## **INTERFACE LAN1**

### Syntax for Command Parameters

{} == one of the parameters in set is required

[ ] == one of the parameters in set is allowed (optional)

Show Config All

The **SHOW CONFIG ALL** command provides the means to store and replay an entire configuration. Using a cut and paste operation, configurations may be edited off-line, stored and used later to configure the IP•Tube unit .

## System Level or "General" Commands

**CONFIG**

Enter the configuration mode, with the command **CONFIG**, at which point the following commands may be used:

**SAVE**

Save the changes and exit Configuration mode.

**END [SAVE]**

Exit Configuration mode. The optional SAVE instructs the IP•Tube to save configuration changes.

**RESTORE**

Restores the current IP•Tube configuration, ignoring any changes which have been made during the current Telnet **CONFIG** session.

**PASSWD**

Allows setting or modifying the login password. The IP•Tube ships with no password set. Upon entering the **PASSWD** command, the user is prompted to enter, and confirm, the new password.

**BYE | QUIT | LOGOUT**

Any of these commands will terminate the Telnet session. If you have unsaved configuration changes, you will be prompted to save or discard the new configuration.

**RESET**

Resets the IP•Tube.

**HELP [HELP | ALL | CONFIG | SHOW]**

Provides Help information on a selected list of topics. Typing **HELP** with no argument provides the Help summary screen which is the top-level list of commands.

**CLEAR {LAN1 | LAN2 | S1 | S2 | All}**

Clears the port statistics on the selected port: Ethernet, LAN Port 1, etc.

For the IP•Tube GT1/GE1 use the command:

**CLEAR {LAN1 | LAN2 | S1 | S2 | S3 | S4 | All}**

**HOST NAME namestring**

Provide a unique name for the IP•Tube. The new host name does not take effect until a save and reset is performed.

Example:

**HOST NAME Aptos IPTube**

Note: Earlier versions of the Engage software use the term **ROUTER NAME**.

**TELNET {ON | OFF}**

Turns the ability to telnet into a Tube unit On and Off.

**USER TIMEOUT {Off | 1-60}**

This setting can be turned Off or set to the number of minutes you can leave your console or telnet session idle before the system automatically logs you out. If logged off you must simply log on again. Note: Setting this value to Off or zero disables automatic user logout.

**TERM NN**

Allows the user to tailor the number of display lines to their terminal screen size.

**IP DEFAULT-ROUTER address**

Configures the IP address of the default router or gateway for this Unit. This default router is the system's default router and is used when a specific interface is not set to a higher precedence default router with the Interface config command, **IP Default-router**.

**PING {dest.address} [src.address] [ [ {number}]|spray ]**

Sends an ICMP ECHO message to the specified address. Any source address from an interface on the IP•Tube can be used. This can be useful to test routes across a LAN or WAN interface.

By default, only 1 message, (packet), is sent. A numeric value can be entered to send more than one message. Also **SPRAY** can be used to continually send messages until the ESC key is pressed.

## Upgrade Firmware

**UPGRADE {TFTP Server Addr} {Filename}**

TFTP, (trivial file transfer protocol), provides a means for upgrading IP•Tube firmware in a TCP/IP environment. A TFTP upgrade can be accomplished by aquiring the upgrade file from Engage Communication Technical Support and placing it on your own local TFTP server.

Please see Table 14 - Engage Flash Upgrade Instructions

Example:

**UPGRADE 192.168.1.1 26_72_82_upgrade.upg**

Ensure IP connectivity between the IP•Tube and the TFTP server by pinging from one to the other. Then issue the upgrade command.

Note: An IP•Tube which is running an upgrade must go through a reset. This may cause a Telnet connection to drop. If this does occur, simply re-establish the Telnet connection.

SNMP Configuration

**SNMP {ON | OFF}**

Turns **ON** or **OFF** receipt and transmission of standard SNMP queries, excluding traps.
Note: **OFF** disables processing and responses to standard SNMP queries, excluding traps.

**SNMP COMMUNITYNAME** [ReadWrite]

Set or modify IP•Tube SNMP community name. This string is used for authentication of SNMP SetRequests and SNMP traps.

The default community name is "public".

Note: Do not enter a pass phrase to create the host key or password.

Example: SNMP Community Name Read (Get) Only

IP Tube DLT1#snmp communityname
Enter new password:<password string not echoed>
Confirm new password:<password string not echoed>
IP Tube DLT1#

Example: SNMP Community Name Read Write (Set/Get)

IP Tube DLT1#snmp communityname readwrite
Enter new password::<password string not echoed>
Confirm new password::<password string not echoed>
IP Tube DLT1#

**SNMP TRAPS {ON | OFF}**

Turns **ON** or **OFF** generation of SNMPv1 Traps. The Destination Address for these traps must be configured to be an SNMP management station capable of decoding SNMPv1 traps.

**SNMP TRAPS ADDRESS address**

Sets the Destination IP Address to which the IP•Tube will send SNMPv1 Traps.

## SHOW Commands

**SHOW INTERFACE [LAN1 | LAN2 | S1 | S2] {INFO | STATISTICS}**

For the IP•Tube GT1/GE1 use the command:

**SHOW INTERFACE [LAN1 | LAN2 | S1 | S2 | S3 | S4 ] {INFO | STATISTICS}**

Provides details on any LAN or serial interface. If no interface is specified, either the current interface, per the "**Interface**" command will be used, or all interfaces will be shown.

**INFO**

Details the port type, protocol type, port state, buffer count, etc.

**STATISTICS**

Lists the packets received and transmitted, errors, etc.

**SHOW ROUTER**

Provides general configuration and status information, including the Ethernet hardware addresses

and the firmware version.

**SHOW IP STATISTICS**

Provides more detailed statistics on IP packets only.

**SHOW CONFIG ALL**

Provides a list of all configuration parameters. No argument is the same as ALL. This list provides the basis for storing an IP•Tube configuration into a local text file. The full configuration can be edited in a text editor for simple "cut and paste" configuration of the unit.

**SHOW CONFIG INTERFACE [LAN1 | LAN2 | S1 | S2 | S3 | S4]**

If no interface is specified, either the current interface per the “interface” command will be used, or all interfaces will be shown.

**SHOW CONFIG IP [ALL]**

Details the IP configuration. No argument is the same as ALL, which provides configuration items which don’t pertain to a specific port, i.e. default router, gateway, etc.

**SHOW CONFIG ROUTER**

Lists IP•Tube Hostname, IP Address, etc.

**SHOW SSHD INFO**

Use the Show Info or Show SSHD Info to determine the state of the SSHD Server.

## LAN Interface Statistics

**Packets Received**
The number of LAN packets received.

**Receive CRC**
The packet had a CRC error.

**Receive Overrun**
Overrun of internal FIFO used in transfer of LAN data to memory, or a frame was received and discard due to lack of buffers, or a large frame was received.

**Receive Framing**
A nonoctect aligned frame was received.

**Receive Misc**
A short frame was received, or a general error indicating an unexpected result in an buffer descriptor, or a buffer that was not a complete frame was recieved on the Ethernet channel.

**Packets Transmitted**
Number of LAN packets transmitted.

**Transmit CSL**
Carrier sense lost during frame transmission.

**Transmit UN**
Underrun, the Ethernet controller encountered a transmitter underrun while sending a buffer.

**Transmit RL**
Retransmission Limit. The transitter failed attempts to successfully send a message due to repeated collisions (statistic not set on IPTube).

**Transmit LC**
Late collision. A collision occured after 64 bytes are sent (statistic not set on IPTube).

**Transmit Misc**
Unspecified transmit error not associated with a buffer.

## Serial Interface Statistics

**Packets Received**
Number serial of packetes received

**Receive CRC**
CRC error. Should not occur with Procotol IPTube.

**Receive Overrun**
Overrun of internal FIFO used in transfer of serial data to memory, or a frame was received and discard due to lack of buffers, or a large frame was received.

**Receive Framing**
Set when a frame containing a number of bits not exactly divisible by eight is received.

**Receive Misc**
Carrier Dectect Loss during buffer reception.

**Packets Transmitted**
Number of serial packets transmitted.

**Transmit CSL**
CTS was lost during frame transmission.

**Transmit UN**
Underrun, the serial controller encountered a transmitter underrun while sending a buffer, or a transmit operation failed due to lack of buffers.

**Transmit Misc**
Unspecified transmit error not associated with a buffer.

**Packets Out Of Sequence**
A packet arrived out of sequence. This indicates either a missing packet or a packet received out of order. If Tube SequenceRecovery is On, the packet is placed in the proper order and is not necessarily a data error. If Tube SequenceRecovery is Off, this would be an error in the data stream.

**Last Sequence Disruption x, y**
Packet Sequence Disruption displays the sequence number of packets received adjacent to sequence number gaps. For example, if the display is “5, 7”, that means sequence number 6 was missing. Or, “5, 56”, would indicate 50 packets were missing.

Note the sequence number is modulo 255, so a display of “255, 1” would mean only the packet with sequence number 0 is missing.

**Packets Arriving Too Late**
The packet arrived with a sequence number that had already been transmitted on the serial port. The IP network delayed the packet too late for transmission. This is a data error.

Packets Arriving Late are counted only when Tube SequenceRecovery is On or Protocol ADPIPTube is selected.

**Packets Not Arriving**
A packet for a given sequence number never arrived. This is a data error. Packets Not Arriving are counted only when Tube SequenceRecovery is On or Protocol ADPIPTube is selected.

Gaps in sequence due to Packets Arriving Late or Packets Not Arriving are filled with data from the next arriving packet.

**Packets Rcvd w Bad Source IP Addr**
A packet received with the correct UDP port and destination IP address did not have a source address matching the Tube Destination address. This packet is dropped.

**Packets Rcvd w Bad UDP Port**
A UDP packet received with the correct destination and source IP address did not have a UDP source and destination port number matching the Tube UDPPort number. This packet is dropped.

**Transmit Drain Drops**
This is a serial transmit queue overflow. The number of packets in the serial transmit queue exceeds the setting of Tube Buffers by 3 packets and is dropped.

**Transmit Buffer Queue Depth**
The number of packets in the serial transmit queue.

## SSHD Information

**SSHD: Off**
The SSHD server is configured off. No connections are accepted. If configured On, on unit start up the SSHD server will be in this state for a very short time until the SSHD server is started.

**SSHD: No Host Key, Run SSHD HostKey Enter**
A connection was attempted, but the SSHD server does not have a valid host key. Use the SSHD HostKey Enter command to configure a valid host key. Do not enter a pass phrase.

**SSHD: Stopped**
A brief transient state when SSHD is stopped during a configuration save operation.

**SSHD: Running - No active session**
The SSHD Server is running and ready to accept incoming connections, but no session is currently active.

**SSHD: Running - Session active**
An SSH session is currently active.

## Config Interface Commands

Configuration of the IP•Tube DLT1/DLE1 models involves setting parameters for the Ethernet interfaces, (LAN1 and LAN2), and the Serial interfaces, (S1 and S2) which may be T1 or E1 interfaces. The user must specify which interface is being configured with the command:

**INTERFACE (LAN1 | LAN2 | S1 | S2)**

Configuration of the IP•Tube GT1/GE1 involves setting parameters for the Ethernet interfaces, (LAN1 and LAN2), and the Serial interfaces, (**S1 | S2 | S3 | S4),** which may be T1 or E1 interfaces. The user must specify which interface is being configured with the command:

**INTERFACE [LAN1 | LAN2 | S1 | S2 | S3 | S4]**

Configuration of the RS530, RS232 and V35 models include configuring the device port and the ethernet port. Specify the port to be configred with the command.

**INTERFACE [S1 | LAN1]**

To move up one level, from **Interface Config** mode to **Config mode**, enter the **INTERFACE** command with no argument. To change between interfaces, whether or not in **Interface Config** mode, specify the new interface.

Example:

name(s1)## **INTERFACE LAN1**

Local Area Network Interfaces

**PORT {OFF | ON}**

**PORT** enables or disables the Ethernet interface.

**AUTONEGOTIATION {ON | OFF}**

Enable or disable IEEE 802.3 Auto-Negotiation on the Ethernet interface.

Warning: If the device connected to LAN1 uses Auto-Negotiation and LAN1 is configured to use full duplex without Auto-Negotiation, the other device may operate in half duplex mode by default and successful operation cannot be guaranteed.

**DUPLEX {HALF | FULL}**

Sets the duplex mode for the Ethernet interface. This command only takes effect when Auto-negotiation is configured to **OFF**.

**SPEED {10 | 100}**

Sets the line rate in Mbps for the Ethernet interface. This command only takes effect when Auto-Negotiation is configured to **OFF**.

Note: Full Duplex and Speed of 10 has performance issues.

**BROADCASTRCV {OFF | ON}**

The Ethernet interface can be configured to disable the reception of Broadcast and Multicast packets. The IP protocol uses broadcast packets to resolve the Ethernet MAC Address of the destination IP.

**BROADCASTRCV OFF** requires that the destination IP•Tube or the Default Router and any local device that wants to communicate with the IP•Tube needs to be configured with the MAC address of the IP•Tube in its ARP table. Due to the complexity involved in setting up the IP Address to Ethernet MAC addresses manually it is recommended that **BroadcastRCV** is set to **ON** unless broadcast storms are expected on the network where the IP•Tubes reside. For the Ethernet interface, first specify **INT**, (**Interface**), **LAN1**.

Typically if **BroadcastRCV** is set to **Off** the IP•Tube Ethernet ARP and Tube Ethernet Address need to be configured with the MAC address of the IP•Tube packet's Ethernet destination. Since the destination for the IP•Tube packet will have its broadcast receive turned **Off** also.

**IP ADDRESS address[/mask]**

The interface IP address and subnet mask are required for connection to the network, configuration with telnet or connectivity tests with ping. The subnet mask can be entered in long or short form.

Examples:

IP ADDRESS 192.168.1.1/255.255.255.0

IP ADDRESS 192.168.1.1/24

**IP DEFAULT-ROUTER address**

Configures the IP address of the default router or gateway for this Ethernet interface. This must be an IP address on the same network as the IP•Tube Ethernet interface. This default router takes precedence over the system's default router. Note: If DHCP is ON for this LAN interface the Default-Router/Gateway is discovered.

**8021Q {OFF | ON}**

Enables or disables IEEE 802.1Q tagging of transmitted LAN packets.

**ON** enables 802.1q tagging for all outbound LAN packets for that interface.

**OFF** disables 802.1q tagging and processing for the specified LAN port.

**8021Q VLANID {NN}**

Specifies the VLAN ID for the tag on all transmitted LAN packets. This value only has effect if IEEE 8021Q tagging of LAN packets is enabled.

## DHCP Client & Dynamic Addressing & Dynamic DNS

**DHCPCLIENT {ON | OFF}**

Enables or disables IP address requesting for this LAN port via DHCP. When a DHCP server has granted us an IP address it is displayed in the configuration.

**ON** enables this LAN port to send DHCP discovery packets and use the IP address that a DHCP server will assign to it.
**OFF** disables DHCP discovery and relies on the user's setting of LAN's IP address

Note: DHCP discovery will take precedence the LAN specific IP address and default router settings, but not the OurDNSServer setting.

**TUBE {1 | 2} DYNAMICADDRESS {ON | OFF}**

**ON** enables the Tube to automatically discover the IP address of its partner, this requires that UDP port numbers of both Tubes match.
**OFF** disables automatic discovery and relies on the user setting of Tube Destination Address

In order for the automatic detection to work the remote IP Tube's UDP port number must match the UDP port number of this Tube. If the IP Tube does not successfully detect the address of the remote IP Tube, no IP Tube encapsulated packets are sent out either LAN port.

**Note**: Tube DynamicAddress takes precedence over whatever Tube Destination address is present.

**TUBE {1 | 2} DESTINATION {address | fullyqualifieddomainnamestring}**

The IP address or fully qualified domain name string of the remote IPTUBE that is the destination of the T1/E1 Over IP packets. The 1/2 specifier indicates which Tube this address should be used for. A domain name cannot exceed 63 characters and DHCPClient must be turned on for the corresponding LAN interface in order for the name to be resolved.

Note: Domain names must be specified with periods serparating hostnames, domains, and organization label. Hostnames may not contain spaces.

**DYNAMIC DNS {ON | OFF}**

This enables or disables the updating of an automatically discovered DDNS server with our IP address, so that if the remote IP Tube is configured with our domain name it may find us. This feature requires OurDomainName to be a fully qualified domain name and the DHCPClient enabled on this LAN port in order to work.

Note: DDNS registration retries when no Tube packets are received from the remote IPTube even though a previous registration was successful. This covers the case where a DDNS server database may have cleared its entries after the IPTube had registered.

**OurDNSServer address**

If DDNS is enabled or a Tube stream has a fully qualified domain name specified for its destination, this address specifies the domain name server to either update or query.

Note: To allow DHCP to specify our domain name server, this parameter should be set to 0.0.0.0.

**Example:**

**ourdnsserver 68.94.156.1**

**OURDOMAINNAME domainnamestring**

If DDNS is enabled, this string configures the fully qualified domain name string that we want to correspond to our LAN1 or LAN2 IP address. Note: This name cannot exceed 63 characters.

Example:

ourdomainname us.engage.com

ddns on

## Tube Configuration

The following Serial Interface commands are applicable to IP•Tube DL and G models. The serial interface commands include those which configure the encapsulation parameters. Refer to the T1, E1 or RS530/RS232/V.35/X.21 Interface configuration for their relevant parameters. Note: In multiport/ interface models care must be taken so that the correct interface is selected. For example: INT S3, selects the 3rd physical port.

**TUBE {ON | OFF}**
Turning **Off** the IP•Tube stops the conversion of the Serial Port frames into IP packets.

## TUBE PROTOCOL Commands

**PROTOCOL {IPTUBE | CESoIP | HDLCoIP | ADPIPTUBE | SS7}**
The interface protocol controls the packetization format of the IP•Tube.

**PROTOCOL IPTUBE** Protocol encapsulates the data bits selected into UDP packets.

**PROTOCOL CESoIP**
Protocol encapsulates the data bits selected into UDP packets with an RTP header.

**PROTOCOL HDLCoIP**
Protocol encapsulates HDLC frames into UDP packets with an RTP header. This protocol is used to interconnect data networks that utilize WAN protocols such as PPP, Frame Relay, HDLC and SDLC.

## Assured Delivery Protocol

**PROTOCOL ADPIPTUBE**

Three control settings for the **ADPIPTube** protocol that determine the retransmit algorithm are as follows:

- **Protocol ADPIfPTube LimitRetransmit NN**
- **Protocol ADPIPTube DelayRetransmit NN**
- **Protocol ADPIPTube CountRetransmit NN**

The "LimitRetransmit" parameter determines the maximum number of packets ADP will retransmit after it has sent a Tube packet. "DelayRetransmit" determines how long ADP should wait, in terms of packets, before retransmitting. "CountRetransmit" determines how often a packet should be retransmitted. See a detailed discussion of Assured Delivery Protocol in Chapter 3: *Installation*.

**PROTOCOL ADPIPTUBE DELAYRETRANSMIT NN**
Specify **NN** for the delay before the **ADPIPTUBE** protocol retransmits an unacknowledged packet. The delay is specified in terms of Tube packets.

**PROTOCOL ADPIPTUBE LIMITRETRANSMIT NN**
Specify **NN** for the maximum number of unacknowledged packets the **ADPIPTUBE** protocol retransmits after transmitting a Tube packet.

**PROTOCOL ADPIPTUBE COUNTRETRANSMIT NN**
**NN** specifies the minimum interval, expressed in terms of Tube packets, before a retransmitted packet is retransmitted again. **ADPIPTUBE**
Protocol, (Assured Delivery Protocol) offers reliable delivery of IP•Tube packets in an unreliable network environment. ADP can re-sequence packets delivered out of order and detect and retransmit missing packets. ADP achieves it's purpose by including acknowledgements of received Tube packets in every Tube packet sent. The receiving Tube can then detect and retransmit missing packets.

## SS7 Protocol

**PROTOCOL SS7**

**SS7** Protocol encapsulates SS7 Messages into packets.

**TUBE FISUMASK value**

This value must be a ten digit hex number and must be set to 0xFFFFFFFFFF.

Example:
interface s1
tube fisumask ffffffffff

**TUBE LSSURETRANSMIT {ON | OFF}**

**ON** enables automatic transmission of LSSUs upon startup to provide compatibility with certain soft-switches **OFF** disables automatic transmission of LSSUs upon startup.

Example:

interface s1

tube lssuretransmit on

## TUBE LOOPBACK Commands

**TUBE LOCALLOOP {ON | OFF}**
IP•Tube models DLT1/DLE1/GT1/GE1 only.

Turning on **LOCALLOOP** causes the IP•Tube to loop frames on the Serial Port. Frames received on the Serial Port are transmitted back on the Serial Port. Tube packets received on the Ethernet interface are not transmitted on the Serial Port when **LOCALLOOP** is on. **LOCALLOOP** takes effect after saving a configuration, but will be set **Off** after a subsequent reset.

Turning **LOCALLOOP ON** performs the same function as setting the **TUBE ADDRESS** to the same IP address as the Ethernet interface or setting DIP Switch 4 to **On**.

**TUBE REMOTELOOP {ON | OFF}**
IP•Tube models DLT1/DLE1/QT1/QE1 only.

Turning on **REMOTELOOP** causes the IP•Tube to loop tube packets on the Ethernet interface. Valid tube packets received on the Ethernet interface are transmitted back out the Ethernet interface with the source and destination IP address and UDP ports exchanged. Frames received on the Serial Port are not transmitted on the Ethernet interface when **REMOTELOOP** is **ON**. **REMOTELOOP** takes effect after saving a configuration, but will be set to **Off** after a subsequent reset.

## TUBE CONFIRMREMOTEALIVE Command

**TUBE CONFIRMREMOTEALIVE {ON | OFF | DONOTTALK}**
Turning **CONFIRMREMOTEALIVE ON** will enable the IP•Tube to poll the remote unit and see if it is on-line. If the remote unit is available it will begin streeming IP Packets. This will prevent the IP•Tube from flooding the Network with IP Packets if the remote unit is not avilable.

If **DONOTTALK** is set, the IP•Tube will not poll the remote unit. It will stream packets only if the remote IP•Tube is sending packets. One unit would be set to **CONFIRMREMOTEALIVE ON** and the

other unit to **DONOTTALK**. Seting both IP•Tubes to **CONFIRMREMOTEALIVE DONOTTALK** is not recommended.

If this is **OFF** the IP•Tube will stream data regardless of the remote unit status.

## TUBE LANPORT Commands

**Tube LANPort {LAN1 | LAN2 | Protector | Alternate | AltProtector}**

LAN1 and LAN2 select a single LAN port for the IPTube traffic. The most common configuration is to have the IPTube traffic utilizing LAN1: Tube LANPort LAN1.

## TUBE LANPORT Protector

**TUBE LANPORT *Protector***

The Protector monitors incoming packets for link quality over a period of time. The period of time is specified by **Tube Protector PollingPeriod**. Incoming packets are monitored for percentage of expected packets actually received, the number of packets received out of sequence, the number of times the serial transmit buffer overflows, and the number of times the serial transmit buffer underruns. The threshold for each are independently configured. If any are exceeded during a **PollingPeriod**, the Protector fails over to LAN2.

**TUBE PROTECTOR QUALIFICATION {NN}**

The range is from 30 to 255 seconds. Qualification is the number of seconds the Protector needs a good LAN1, based on RxOutOfSequence, RxPacketPercent, TxDrainDrops, TxUnderruns, before it will switch back to LAN1. This is useful only for reporting purposes, as in which LAN the Protector thinks has good packets. Otherwise Enhanced Mode is transmitting on both LANs and receiving packets from both LANs, effectively without descrimination.

**TUBE PROTECTOR TRANSMITTER {ON | OFF}**

Turning Transmitter OFF is for use with simplex applications such as one way satellite broadcasts.

**TUBE PROTECTOR RECEIVER {ON | OFF}**

Turning Receiver OFF prevents the reception of Tube packets. This should only be used on simplex circuits at the trasmit side.

**TUBE PROTECTOR HARDSWITCH {ON | OFF}**

The Protector will transmit on LAN2 only when LAN1 has failed.
HardSwitch should be set Off for Enhanced Mode On. This ensures the IPTube transmits on both LAN1 and LAN2.

Note: Tube Protector HardSwitch if forced ON for IP•Tube T3 and E3 products. HardSwitch OFF is not supported. Also, RxOutOfSequence, TxDrainDrops and TxUnderruns are not supported as failover criteria for T3 and E3 products.

Note: Protector HardSwitch On does not make sense for ENHANCED MODE because then the Protector will transmit on LAN2 only when LAN1 has failed.

**TUBE PROTECTOR POLLINGPERIOD {NN}**

PollingPeriod is the period in seconds in which the Protector evaluates received packets out of sequence, received packet percentage, transmit drain drops and transmit underruns for thresholds of the configuration values set below to determine whether to fail over to LAN2. PollingPeriod is a Protector configuration parameter is not relevant when both Protector is configured to utilize both LAN1 and LAN2 in a fully redundant mode such as Enhanced Mode.

**TUBE PROTECTOR RxOutOfSequence {NN}**

Defines the number of Receive Out Of Sequence packets encountered during the polling period to cause a switch.

**TUBE PROTECTOR RxPacketPercent {NN}**

Defines the number of Receive Packet Percentage during the polling period to cause a switch.

**TUBE PROTECTOR TxDrainDrops {NN}**

Defines the number of Transmit Drain Drops encountered during the polling period to cause a switch.

**TUBE PROTECTOR TxUnderruns {NN}**

Defines the number of Transmit Underruns encountered during the polling period to cause a switch.

## Enhanced Protector Commands

**TUBE PROTECTOR ENHANCED MODE {ON | OFF}**

Enhanced Mode, **optional**, is designed to accommodate the packet arrival delay that can occur between LAN1 and LAN2 packet networks. Buffering is added to the faster path so that packet loss on one link is replaced with a packet from the other link without a fault. Enhanced mode is specifically designed to work with the difference between Satellite and Terrestial network delays.

Interoperability requires recieving IPTube also be configured for Enhanced Mode since Enhanced Mode uses 16 bit sequence numbers. The Secondary Queue from LAN2 provides redundancy for LAN1 packet loss or outage. Buffers are synchronized with LAN1 buffer to hold up to 500 milliseconds of delay from LAN1.

**TUBE PROTECTOR ENHANCED {RECEIVER | TRANSMITTER}**

The Enhanced Protector allows a unit to be configured as a receiver or a transmitter to accommodate simplex connections. This command selects whether or not the LAN interfaces transmit IP Tube packets. However, if a unit is configured as a transmitter, it is still capable of receiving a data stream.

**TUBE PROTECTOR ENHANCED PRIMARY {LAN1 | LAN2}**

The Enhanced Protector allows a user to designate either LAN1 or LAN2 as its Primary port. The other LAN port becomes the Secondary port. The Secondary port is responsible for sending or receiving the packet stream if the Primary port is either down or consistently mssing packets.

Packets arriving on the Primary port form the basis for maintaining the serial transmit queue at a size of Tube Buffers. It is expected that the packets have arrived earlier from the Secondary port. Packets from the Secondary port will be used to fill the serial transmit queue if packets are missing from the Primary port.

## TUBE LANPORT Alternator Configuration

**TUBE LANPORT *Alternate***

The **ALTERNATE** setting enables IP•Tube load splitting in which the load is split across both Ethernet interfaces.

Note: Each LAN port has independent configurations for its IP Address and Default Router/Gateway.

Note: Transmit packets can be sent on one Ethernet and Received on the other to support Asymetrical Bandwidth connections such as ADSL.

Alternatively the IPTubes packets can send the Even numbered packets on one LAN and odd packets on the other LAN with the ALTERNATOR Option.

Note: ALTERNATE is used when bandwidth is limited on the LAN1 or LAN2 and there is sufficient bandwidth for the T1/E1 Over IP traffic when it is split over multiple WAN connections such as xDSL. If WAN fault tolerance is required, either the LAN1 or LAN2 connection fails, a reduced bandwidth connection can be activated with the ***AltProtector*** Configuration.

## TUBE LANPORT AltProtector Configuration

**TUBE LANPORT *AltProtector***

The **ALPROTECTOR** setting **selects the combination of Alternate and Protector.**

When both LAN ports are available, the IPTube load balances between them as in the Alternate option. If one of the LAN connections becomes unavailable or has degraded by the criteria set for the Tube Protector option, the IPTube traffic is sent exclusively down the available LAN port.

**Tube Protector Criteria - refer to the TUBE PROTECTOR commands for more details**

**Tube Protector PollingPeriod nn**

**Tube Protector RxOutOfSequence nn**

**Tube Protector RxPacketPercent nnn**

**Tube Protector TxDrainDrops nn**

**Tube Protector TxUnderruns nn**

**Tube Protector Qualification nn**

If the TUBE fails over to a single LAN connection, the TDM over IP connection will need to reduce the number T1 or E1 Timeslots/Channels/DS0s being packetized so that packet traffic does not exceed the bandwidth of the functioning LAN link. The ***ProtectorChannels*** command configures the number of channels that are packetized when only one connection is fully functional.

**{T1 | E1} ProtectorChannels {FULL | {NN XX | {{NN | Y-Z}[,MM | ,Y-Z]}}}**

ProtectorChannels designates the channels transmitted and received during AltProtector failover. Channels can be specified Full, a start channel and number of channels (NN XX), a single channel (NN or MM), or a range of channels (Y-Z). Single channels and ranges of channels are separated by commas and can be combined.

**Example:**

Assume each LAN Port has enough bandwidth for a half T1, or 12 channels. With AltProtector, the IPTube T1 Channels is configured as Full since the T1 load is split evenly two LAN ports. If the

AltProtector fails over to a single LAN, T1 ProtectorChannels limits it to only 12 channels, thus not exceeding the bandwidth of the functional LAN Connection.

**Tube LANPort AltProtector**
**T1 Channels Full**
**T1 ProtectorChannels 1-12**

## TUBE PACKET Configuration

**TUBE ADDRESS addr**
Used to configure the destination IP address of the remote IP•Tube.

Note: If the **TUBE ADDRESS** is configured with the same IP address as the IP•Tube Ethernet interface (LAN1), a loopback of the T1 over IP port S1 will occur.

**TUBE {LAN1 | LAN2} DESTINATION addr**

Used to configure the destination IP address of the remote IP•Tube, in conjunction with the **{LAN1 | LAN2}** specifier, which indicates the Ethernet interface for this destination IP address.

Note: for the Enhanced Protector the capability has been given to allow an IP Tube to both receive and transmit a multicast stream. This requires that "tube 1 destination" be indentically configured with the same IP multicast address on both the transmitting Tube and on all receiver Tubes. The Receiving IPTubes use the Multicast address to configure their Ether receiver.

Multicast Example: tube 1 destination 224.0.0.1

**TUBE ETHERNET ARP {ON | OFF}**

**TUBE ETHERNET ARP OFF** uses the Ethernet MAC address specified by the **TUBE Ethernet Address**.

**TUBE ETHERNET ARP ON** uses the Ethernet MAC address obtained automatically by the IP•Tube's IP to Ethernet MAC Address Resolution Protocol, (ARP).

Note: The default configuration for **TUBE ETHERNET ARP** is **On**.

**TUBE [1 | 2] ETHERNET ARP {ON | OFF}**

The **[1 | 2]** specifier selects the Ethernet interface for **TUBE ETHERNET ARP**. If **[1 | 2]** is not specified, **TUBE ETHERNET ARP** is configured for LAN1.

**TUBE ETHERNET ADDRESS aabbccddeeff**

Specifies the Ethernet MAC address for the IP•Tube IP packet. The **TUBE Ethernet MAC Address** needs to match the MAC address of the destination IP•Tube or the Default Router. The MAC address is entered without the **|** character. Only enter the 6 bytes of MAC address, i.e. 001122334455.

Note: Unless Broadcast storms are suspected it is highly recommended that the automatic resolution of the IP address to Ethernet MAC address is utilized.

**TUBE [1 | 2] ETHERNET ADDRESS aabbccddeeff**

**TUBE ETHERNET ADDRESS** specifies the Ethernet MAC address for the IP•Tube IP packet. The **[1 | 2]** specifier selects the Ethernet interface for the Ethernet MAC address. If **[1 | 2]** is not specified, the Ethernet MAC address is configured for LAN1.

**TUBE {1 | 2} ROUTE {ON | OFF | addr}**

Used to configure the default route for IP•Tube packets. The **{1 | 2}** specifier indicates the Ethernet interface for the IP•Tube packet default route.

**TUBE {1 | 2} ROUTE ON**

Enables the default route for IP•Tube packets. This default route takes precedence over the Ethernet interface default route and the system default route for routing IP•Tube packets. **TUBE {1 | 2} ROUTE** is not visible in the **SHOW CONFIGURATION** command until **TUBE {1 | 2} ROUTE** is configured to **On**.

**TUBE {1 | 2} ROUTE OFF**

Disables this setting of default route for IP•Tube packets. IP•Tube packets are routed using the Ethernet interface default route or the system default route. **TUBE {1 | 2} ROUTE** is not visible in the **SHOW CONFIGURATION** command when **TUBE {1 | 2} ROUTE OFF** is configured.

**TUBE {1 | 2} ROUTE addr** configures the IP address of the IP•Tube packet default route. This must be an IP address on the same network as the IP•Tube Ethernet interface.

**TUBE UDPPORT value**

**TUBE UDPPORT** specifies the UDP port source and destination address. The IP•Tube only accepts packets that match its UDP Port configuration.

Note: Engage has registered with the IANA UDP, port 3175 decimal. For the IP•Tube use the following UDP port numbers depending on which ports are activated:

- Port 1 UDP port 3175
- Port 2 UDP port 3176
- Port 3 UDP port 3177
- Port 4 UDP port 3178

**TUBE [1 | 2] UDPPORT value**

**TUBE UDPPORT** specifies the UDP port source and destination address. The **[1 | 2]** specifier indicates the Ethernet interface for this UDP port source and destination address. If **[1 | 2]** is not specified, the UDP port source and destination address is configured for LAN1.

**TUBE BUFFERS value**

As IP/UDP packets are received at the IP•Tube Ethernet interface, they are buffered prior to the enabling of the T1 transmitter. This provides for elasticity. The **TUBE BUFFERS** setting permits the user to configure the number of packets buffered with valid settings from 4 to 85.

Note: for the Enhanced Protector the number of packets buffered before serial transmission may not be set lower than 20, but still may be set as high as 30

A large value provides greater elasticity but can introduce significant delay. The amount of delay can be calculated based on the T1 data rate, the **TUBE FPP** setting, (see details below), and the **TUBE BUFFERS** setting. See Chapter 6: *IP•Tube Configuration and Operation* for a detailed analysis of how the IP•Tube settings and the LAN/WAN interconnection contribute to the overall round trip delay or latency.

Note: Round trip delays in excess of 20 milliseconds may require Echo Cancellation. ECAN is not field upgradable, must be ordered at time of purchase.

**TUBE OVERFLOWLIMIT value**

Specifies how many Tube packets in excess of the Tube Buffers setting that the serial transmitter may accumulate before dropping packets. This condition occurs when the sending side is sending Frames at a higher data rate than they are being clocked out the overflowing sides clocking rate. Additionally when there is a "kink" in the Tube packet flow and a burst of packets are received that are greater than the Tube Buffer setting.

**TUBE FPP value "for T1 interfaces"**

Frames-Per-Packet specifies the number of frames received on the T1 interface to be encapsulated in a single IP/UDP packet. The size of the serial interface frame depends on the interface provided in the IP•Tube. For the T1 interface, the frame size is 192 bits + 1 framing bit (depending on T1Framing config).

T1 **FPP** is configurable in increments of 8. Proper configuration of **FPP** is appplication dependent. Low latency applications, such as voice, require minimum **Frames Per Packet**. The recommended T1 configuration for low latency is **FPP = 8**.

**TUBE FPP value "for E1 Interfaces"**

**FPP, (Frames-Per-Packet),** specifies the number of frames received on the E1 interface to be encapsulated in a single IP/UDP packet. The size of the serial interface frame depends on the interface provided in the IP•Tube. For the E1 interface, the frame size is 256 bits.

**E1 FPP** is configurable in increments of 4. Proper configuration of **FPP** is application dependent. Low latency applications, such as voice, require minimum **Frames Per Packet**. The recommended E1 configuration for low latency is **FPP** = 8.

**TUBE SEQUENCERECOVERY {ON | OFF}**

Sequence Recovery puts out of order packets in the proper sequence for transmission out the TDM interface. This function should always be **ON**.

Note: The lastest versions of software have TUBE Sequence recovery set to ON and do not provide the CLI command for TUBE SEQUENCERECOVERY.

**IP DUPLICATES [0 | 1 | 2]**

The IP Duplicates function sends duplicate packets. This is useful for lossy networks. Although transmission of duplicate packets requires double or triple the bandwidth and should only be used when there is sufficient bandwidth otherwise it can exacerbate the network interconnet's ability to provide a quality connection.

## Tube SCADA Configuration

**Tube SCADAmode { Off | Remote }**

SCADAmode enables features for SCADA applications.

When SCADAmode is Remote, the IPTube performs two additional functions.

Serial input at Port 1 is duplicated on Port 2 In this way a remote station can be sending data to a central and backup control station.

The Serial Port 1 would be configured to go to the central control station and the Serial Port 2 would be configured to go to the backup control station.

Also when SCADAmode is Remote, the IPTube determines whether the central or backup station is actively sending a message and routes that data to port 1.

## Tube Quality of Service

**TUBE ETHERNET {802.1P | 802.1Q} {ON | OFF}**

Enables or disables IEEE 802.1P/Q tagging of transmitted IP Tube packets.

**ON** enables 802.1q tagging for all outbound LAN packets and 802.1q processing for inbound LAN packets for the Ratelimiter Tubes, this setting applies to both LAN ports, for non-Ratelimiter Tubes for only the specified LAN port (must preceed with "interface LAN1" or "interface LAN2" command **OFF** disables 802.1q tagging and processing.

**TUBE ETHERNET 802.1P PRIORITY {NN}**

Sets the value of the priority tag on transmitted IP Tube packets. The valid range is 0 to 7. This value only has effect if IEEE 802.1P tagging of Tube packets is enabled.

**TUBE ETHERNET 802.1Q VLANID {NN}**

Specifies the VLAN ID for the tag on transmitted IP Tube packets. This value only has effect if IEEE 802.1P/Q tagging of Tube packets is enabled.

**TUBE TOS**

Sets the Type of Service Byte in the IP packets in which T1/E1 frames are encapsulated. The setting of the TOS byte can be used to ensure that the real time TDM data from the IP•Tube is ensured high priority, assuming Quality of Service support is provided by each router or switch in the IP path between the IP•Tubes. Alternatively the IP destination address can be used to ensure that the IP•Tube IP packets receive the required priority and bandwidth. IP TOS is defined in the IETF RFC 1349, accessable online at www.ietf.org. A TOS setting of 0x08 maximizes throughput.

**TUBE [1 | 2] TOS {0xNN}**

Sets the Type of Service Byte in the IP packets in which the T1/E1 frames are encapsulated. The **[1 | 2]** specifier selects the Ethernet interface for the Type of Service Byte. If **[1 | 2]** is not specified, the Type of Service Byte is configured for LAN1.

Displayed in hex, with values ranging from 0x00 to 0x08. Preceding the entry with 0x results in a direct Hexidecimal input.

Example:

Tube 1 TOS 0x08

**Note:** It is possible to set the Differentiated Services Code Point (DSCP) field using the TOS value. The Differentiated Services (DiffServ) uses the same byte in the IP Header as the TOS. The 6 MSB of the TOS byte are the same bits used for setting the DSCP value. To enter the Expedited Forwarding (EF) DSCP value enter the following hex value in the TOS field: **0xB8**. This will mark these packets as EF.

## Tube Compression

**TUBE COMPRESSION {ON | OFF}**

Enables and disables compression on IP•Tube C models. IP•Tube DLT1/E1-C and GT1/E1-C models are equipped with Compression Capability.

**TUBE COMPRESSION SILENCEDETECT {ON | OFF}**

When **TUBE COMPRESSION** is **On**, **SilenceDetect** can be enabled or disabled. **SilenceDetect** is a lossy compression of a silent or nearly silent voice channel.

**TUBE COMPRESSION SILENCEDETECT THRESHOLD {0 - 6}**

**SilenceDetect Threshold** determines the signal level that is considered to be silence.

A **Threshold** of **0** is a zero signal level. If all the Mu-Law data of a channel in a Tube packet are at a level of zero, the channel will be compressed.

A **Threshold** of **1** compresses the data of a channel if the Mu-Law values are between +1 and -1.

A **Threshold** of **2** compresses channels with Mu-law values between +3 and -3.

A **Threshold** of **3** compresses channels with Mu-Law values between +7 and -7.

A **Threshold** of **4** compresses channels with Mu-Law values between +15 and -15.

A **Threshold** of **5** compresses channels with Mu-Law values between +31 and -31.

A **Threshold** of **6** compresses channels with Mu-Law values between +63 and -63.

Note: the maximum Mu-Law values are -127 and +127 and are a nonlinear representation of the signal.

**TUBE COMPRESSSION SILENCEDETECT CHANNELS**
**{ALL | NONE | [NN XX | {{NN | Y-Z}[,MM | ,Y-Z]}}]}**

**SilenceDetect Channels** selects the channels for silence compression. **ALL** selects all T1 channels for **SilenceDetect** lossy compression. **NONE** selects no channels and effectively turns **SilenceDetect OFF**.

Individual channels can be selected with the form **NN XX**, where **NN** is the start channel and **XX** is the number of channels. Alternatively, the form MM can select individual channels separated by commas, or the form **Y-Z** can select a range of channels. Individual channels and a range of channels can be combined on a command line.

## T1/E1 Multiplex Option

**TUBE MUX {ON | OFF}**

**ON** enables the Tube to create DS0 groups to multiplex multiple Tube streams from remote locations onto a single T1/E1 port.
**OFF** disables Tube multiplexing and only passes one stream in a point to point configuration.

Example:
interface s1
tube mux on
tube mux plltube NN

Note: Tube FPP must be a number that divides by 8 when MUX is ON.

Note: if the T1 or E1 interface is using PLL clocking, this command enables a Tube to lock on to the data rate of the specified DS0 group number (tube S1.NN} for all Tube streams for this interface.

Note: Copying and Pasting a configuration for a unit currently doesn't work. Please follow the steps below to create a script that can be Pasted to create the MUX subinterfaces.

**ADDTUBE XX YY**

Creates a DS0 group with its own protocol and Tube parameters with the starting DS0 at XX and number of DS0s of YY

Note: This command may only be used if Tube Mux is on, and if a Tube is currently not being selected. A Tube is created with its own parameters including buffers, frames per packet, and destination IP address. The channels specified may not overlap with an existing multiplexed Tube.

**TUBE {S1.1 | S1.2 | S1.x}**

Specify the Tube for the Tube-specific configure commands. TUBE with no parameter clears the Tube setting.

**Note: When entering into MUX subinterface using 'Tube S1.2', currently there is no change in the command line to note you are in the subinterface. It will only show 'IP Tube (S1)#'**

**Note: 'Tube LAN1 Destination' doesn't presently work for entering in IP Address, please use 'Tube Address' to properly enter the IP Address value into the configuration.**

Example:

interface s1
t1 clocking pll
tube mux on
tube mux plltube 1

addtube 1 2
addtube 3 2
addtube 5,8-10

tube s1.1
tube on
tube udpport 3175
tube address 192.168.1.51
tube s1.2
tube on
tube udpport 3176
tube address 192.168.1.52
tube s1.3

tube on
tube udpport 3277
tube address 192.168.1.53
save
yes

**DELTUBE S1.NN**

Deletes the DS0 group associated with Tube S1.NN from the configuration.

Note: This command may only be used if Tube Mux is on. After a save, this command deletes all information that is owned by this Tube and no longer multiplexes the channels specified by this Tube. This command will delete the tube specified and shift the remaining Tube groups to fill in the deleted MUX group.

Example: If there are s1.1, s1.2, s1.3 and s1.4 MUX groups
interface s1
deltube s1.2
sa
y

The will delete the S1.2 MUX group, but will shift S1.3 and S1.4 so you will be left with S1.1, S1.2 and S1.3. The S1.3 moves to S1.2 and S1.4 moves to S1.3.

## T1 Interface

The following Serial Interface commands are applicable to IP•Tube DL and G models T1 interface configurations.

**TYPE**

The **TYPE** parameter is factory configured to match the Serial port's hardware and should be set to **T1**.

**TUBE FRAMING {T1FRAMED | TRANSPARENT | MULTIFRAME}**

Sets the framing of the T1 data which is encapsulated into IP packets.

**T1Framed**
Encapsulates the framing byte along with the DS0 data. Using a Loopback plug with T1Framed is not a valid test configuration.

**Transparent**
Only the data in the selected DS0's is transported in the IP•Tube. The T1 framing byte is not encapsulated.

Note: The selection of the T1/E1 DS0's starting channel and number of channels is setup by the Serial Interface's T1/E1 configuration commands. A DS0 is a 64 Kbps Voice/Data circuit.

**Multiframe**
The T1 frames are packetized in Multiframes. A T1 Multiframe is 24 T1 frames with the ABCD signaling bits aligned. Multiframed is required with Echo Cancellation in order not to alter the ABCD signaling bits only if the Phone system are using Robbed Bit Signaling. For example, E&M or Channel Bank circuits would require Tube Framing Multiframe and T1 Signaling Robbedbit for use with Echo Cancelation. PRI and signaling that uses an individual DS0/Timeslot such as number 24 is not Robbed Bit Signaling.

**T1 DATA {NORMAL | INVERTED}**

Can be set for **Normal** or **Inverted** and must match the setting of the DSU/CSU on the other end.

**T1 TXUNDERRUNAIS {ON | OFF}**

**ON** Enable the transmission of an unframed All Ones BLUE Alarm Code out the T1 interface if the T1 transmitter underruns. This is only required when Tube Framing is set to transparent and the Telco equipment does not identify a framed All Ones as a BLUE Alarm. Note: Transmit Underruns occur when the IP packets flow is interrupted or stopped.

**OFF** disables generation of an **AIS.**

**Note:** Tube Framing T1 sends an All Ones out the T1 interface in the event of an underrun regardless of this setting.

**T1 CLOCKING {NETWORK | INTERNAL | V2PLL | PLL | GPS |OCXO | GPSBackupOCXO }**

Determines the source of Transmit Clock (TxCk). When set to **Network**, the DSU/CSU derives its transmit timing from the received data (RxD) and is therefore synchronized with the telco (the phone network). This is generally used when connecting through commercial carriers.

When set to **Internal**, the DSU/CSU transmits data at a rate set by an internal clock. This mode is referred to as "Master" timing and is used when testing on the bench - one unit set to "Master", the other to "Slave".

When set to **GPS**, the DSU/CSU transmits data at a rate set by a GPS Antenna. This mode is also referred to as "Master" timing. If using this setting the other unit should be set to "Slave".

When set to **V2PLL or PLL**, the tube tunes its transmit clock to match the rate of the remote tube.

When the remote tube clocking is **Internal**, **Network** or **GPS**, this tube should be set to **V2PLL**.

Note: T1 Clocking GPS, OCXO and GPSBackupOCXO is only available for the IP•Tube G4 as an upgradable options.

**T1 Equalization {ON | OFF}**

Enables or disables the Equalizer feature, which provides automatic receive line sensitivity adjustment. T1 Equalizer should be on when the T1 signal levlel is below 10dB. In general it is fine to have the Equalizer ON for all installations.

**T1 MODE {Term | Monitor}**

Sets the interface mode of T1 interface. Term is used when the T1 interface is the only one connecting to the T1 device.

**Note**: Monitor mode must only be selected for T1 line receiving only on circuits with substantial signal attenuation such as encountered when connecting into a T1 Monitor jack with isolation resistors. Monitor mode is used primarily for signal analysis.

**T1 LBO {CSU {0dB | -7.5dB | -15 dB | -22.5dB} | DSX-1 NN}**

This setting determines the transmitted data (TxD) waveform to compensate for attenuation on the T1 line. Typically **Line Build Out** is set to the **CSU** mode, where the build out is specified in dB. In applications where the T1 cabling is short, (the T1 interface is within 20 feet of the network termination), set **T1 LBO** for **0 dB**.

**T1 FRAMING {ESF | D4}**

Selects whether **ESF,** (Extended Super Frame), or **D4** framing is to be used. This pararmeter is determined by the T1 service provider.

Note: The selection of the T1/E1 DS0's starting channel and number of channels is setup by the Serial Interface's T1/E1 configuration commands. A DS0 is a 64 Kbps Voice/Data circuit. E1 frames have 31 DS0s plus a Framing/Signaling Byte for a total of 32 bytes per frame.

**T1 CODING {B8ZS | AMI}**

Selects whether **B8ZS** or **AMI**, (Alternate Mark Inversion), line coding is used. The T1 service provider will specify.

**T1 SPEED {56K | 64K}**

**56K** setting configures all the T1s DS0 Timeslots to operate at 56 Kilobits.
**64K** setting configures all the T1s DS0 Timeslots to operate at 64 Kilobits.
Note: only Tube Protocol SS7 or HDLCoIP would need to have the T1 Speed set to 56k and only if that is the data rate on the timeslots. All other configurations need to be set to 64 Kilobit clear channel.

**T1 IDLECHARACTER 0xNN**

The **T1 IDLECHARACTER** is used with fractional T1 configuration to specify the value for the non selected T1 channels. The purpose of the **IDLECHARACTER** is to ensure that **ESF** framing's CRC is done without errors. The **IdleCharacter** setting of the T1 device attached to the Tube's T1 interface needs to be matched when the IP•Tube is set to transport the framing bit, **TUBE FRAMING T1 FRAMED** and the T1 interface is a **Fractional** T1 and the T1 framing is **ESF**.

**T1 CHANNELS {FULL | FRACTIONAL {NN XX | {{NN | Y-Z} [,MM | ,Y-Z]}}}**

Indicates if T1 line usage is all channels, or **Fractional**.

**FULL** will utilize all channels. When **Fractional** is selected, additional options are presented.

For Fractional T1 with contiguous channels, **NN** is the first T1 channel in use (1 - 24) and **XX** is the number of channels to be used.

In the case that a 384 Kbps fractional T1 uses channels 1 through 6. Start Channel: 1 and Total Channels: 6. where **NN** defines the Start Channel; **XX** is the total number of channels.

**T1 FRAC 1 6**

Alternatively for channels in use that are not contiguous, **NN** and **MM** are single T1 channels in use and **Y-Z** are a range of T1 channels in use. Single channels and ranges are separated by commas and can be combined on a command line.

For example, an ISDN PRI link uses channel 24 for D Channel signaling and 5-20 for voice circuits

**T1 FRAC 5-20,24**

**TUBE LoopCodeResponse {LLBCSU | LLBTube | RLBCSU | RLBTube | OFF}**

This format of the command specifies what type of response, if any, the selected serial interface enacts if a loop code is received.

**-LLBCSU** specifies that a loop code will either enable or disable local loopback through the CSU hardware.

**-LLBTube** specifies that a loop code will either enable or disable Tube Localloop, which is a packet path loopback.

**-RLBCSU** specifies that a loop code will either enable or disable remote loopback through the remote IPTube's CSU hardware.

**-RLBTube** specifies that a loop code will either enable or disable Tube Remoteloop, which is a packet path loopback.

If RLBCSU or RLBTube are specified, then Tube AcceptRLBResponse must be On at the remote IPTube.

If Tube LoopCodeResponse is off then a loop code will not affect the loopback state of either IPTube.

Example:

config
int s1
tube loopcoderesponse llbcsu

**TUBE LoopCodeResponse {UP {CODE | LENGTH NN} | DOWN {CODE | LENGTH NN}}**

If the first argument is UP, CODE specifies the hexadecimal code for LOOP UP, and LENGTH specifies the length of the code in bits.

If the first argument is DOWN, CODE specifies the hexadecimal code for LOOP DOWN, and LENGTH specifies the length of the code in bits.

Example:
config
int s1
tube loopcoderesponse llbcsu
tube loopcoderesponse up code 1
tube loopcoderesponse up length 5
tube loopcoderesponse down code 1
tube loopcoderesponse down length 3

**TUBE AcceptRLBRequest {ON | OFF}**

AcceptRLBRequest must be On for a local IPTube to respond to loopback requests from a remote

IPTube configured with LoopCodeResponse RLBCSU or RLBTube. Otherwise, loopback requests from the remote IPTube are ignored.

Example:
config
int s1
tube acceptrlbrequest on

**SSHD {On | Off}**

Enables or disables the SSH Server.

**SSHD Port <port number>**

Specifies the TCP port number for incoming SSH sessions.

**SSHD HostKey Enter <OpenSSH DSA Key>**

Configures the SSH Server host key. The SSH Server must have a host key for an SSH Client to accept a connection from the Server. The <OpenSSH DSA Key> must be in OpenSSH format.

Units shipped with this base firmware or later versions have an SSH Server host key already configured. Use this command to change the host key.

Units running base firmware that did not previously support SSH will need to run this command after an upgrade to a version that supports SSH.

Most SSH Client software have the facility to generate an OpenSSH host key. The text of a key generated by client software can be used as the <OpenSSH DSA Key> in the SSHD HostKey Enter command.

**Note: When creating a key do not enter a pass phrase.**

**Note: There will be two keys generated when creating a key, use the file without the '.pub' extension.**

Example:
OpenSSH provides the sys-keygen program. Run:
ssh-keygen -b 1024 -t dsa -f <filename>

ssy-keygen creates a private key in filename and a public key in filename.pub. Enter the text of the private key as the <OpenSSH DSA Key> in the SSHD HostKey Enter command.

SecureCRT can create an OpenSSH format private key. In the tools menu, select Create Public Key. Execute the Key Generation wizard to create a client key (the client key can be used as a host key). Choose type DSA and 1024 bits. Select OpenSSH format when it saves the private key in a file. Used the saved file as the input to the SSHD HostKey Enter command.

Changing a host key can have repercussions amongst clients. The next time they connect to the server, they may prompt the user if they want to continue even though the Server key has changed or refuse the connection entirely.

Troubleshooting SSHD
If an SSH client cannot make a connection to the IPTube, check the following items.

Make sure the SSHD is configured on.

Check the SSHD Port number is the same as the Client attempting the connection.

Look at the "Show SSHD Info" status. Check if SSHD is On, or there is already a session active (only one allowed), or the host key is not valid.

Use the Client logging facilities to gather information about the failed connection attempt. For the OpenSSH client, use the -vvv option.

For the SecureCRT client, select the Raw Log Options from the File menu.

## T1 Echo Canceller

**T1 ECHOCANCELLER {ON | OFF}**

Enables or disables echo cancellation. ECAN is not field upgradable, must be ordered at time of purchase.

**T1 OFFECHOCHANNELS {ALL | NONE | {NN XX | {{NN | Y-Z}[,MM | ,Y-Z]}}}**

Indicates on which channels echo cancellation is disabled.

**ALL** disables all channels from echo cancellation.

**NONE** enables all channels for echo cancellation.

To selectively disable individual channels, **NN** is the start channel and **XX** is the number of channels to be disabled. **NN** and **MM** are single channels to be disabled and **Y-Z** are a range of channles to be disabled. Single channels and ranges are separated by commas and can be combined on a command line.

Alternatively for channels in use that are not contiguous, **NN** and **MM** are single T1 channels in use and **Y-Z** are a range of T1 channels in use. Single channels and ranges are separated by commas and can be combined on the command line.

For example, an ISDN PRI link uses channel 24 for D Channel signaling thus one would want to disable channel 24 for echo cancellation.

**T1 OFFECHOCHANNELS 24**

**T1 SIGNALING {NONE | ROBBEDBIT}**

Sets the T1 signaling mode when echo cancellation is on, **ROBBEDBIT** selects robbed bit signaling mode, only necessary when echo cancellation is on and the T1 is transporting robbed bits. This would require Tube Framing set for Multiframe as well. E&M or Channel Bank circuits would require Tube Framing Multiframe and T1 Signaling Robbedbit to allow proper transport of the T1 while using Echo Cancellation.

**NONE** selects no special signaling mode for T1 Enables or disables echo cancellation.

## E&M, Channel Bank and Robbedbit Configuration Example for T1 Echo Cancellation

This is an example configuration for running **TUBE FRAMING MULTIFRAMED** and **T1 ECHOCHANCELLER ON** for E&M, Channel Bank and Robbedbit transport.

**Master Unit**

```
Interface S1
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Multiframe
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.51
 Tube 1 UDPPORT  3175
 Tube 1 TOS  08
 Tube Buffers 13
 Tube FPP 24
 Tube Duplicates 0
 Tube Compression Off
 Tube Compression SilenceDetect Off
```

```
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 T1 Data              Normal
 T1 Clocking          PLL
 T1 LBO               CSU          0dB
 T1 Framing           ESF
 T1 Coding            B8ZS
 T1 IdleCharacter     0x7F
 T1 Channels          Full
 T1 EchoCanceller     On
 T1 Signaling         RobbedBit
 T1 OffEchoChannels   None
```

**Slave Unit**

```
Interface S1
 Type T1
 Protocol IPTube
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube Framing Multiframe
 Tube LANPort LAN1
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  08
 Tube Buffers 13
 Tube FPP 24
 Tube Duplicates 0
 Tube Compression Off
 Tube Compression SilenceDetect Off
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 T1 Data              Normal
 T1 Clocking          Internal
 T1 LBO               CSU          0dB
 T1 Framing           ESF
 T1 Coding            B8ZS
 T1 IdleCharacter     0x7F
 T1 Channels          Full
 T1 EchoCanceller     On
 T1 Signaling         RobbedBit
 T1 OffEchoChannels   None
```

## E1 Interface

The IP•Tube is available with an E1 interface, providing connection speeds up to 2.048 Mbps. The following Serial Interface commands are applicable to IP•Tube models connecting to E1 interfaces. The serial interface commands include those for the E1 DSU/CSU parameters.

**TYPE**

The **TYPE** parameter is factory configured to match the Serial port's hardware and should be set to **E1**.

**TUBE FRAMING {E1FRAMED | TRANSPARENT}**

Determines whether the E1 framing byte is encapsulated in the IP/UDP packet along with the DS0 data.

**E1Framed**

Encapsulates the framing byte along with the DS0 data. Using a Loopback plug with E1Framed is not a valid test configuration.

**Transparent**

Only the data in the selected DS0's is transported in the IP•Tube. The E1 framing byte is not encapsulated.

Note: The selection of the T1/E1 DS0's starting channel and number of channels is setup by the Serial Interface's T1/E1 configuration commands. A DS0 is a 64 Kbps Voice/Data circuit. E1 frames have 31 DS0's plus a Framing/Signaling Byte for a total of 32 bytes per frame.

**E1 TXUNDERRUNAIS {ON | OFF}**

**ON** Enable the transmission of an unframed All Ones BLUE Alarm Code out the E1 interface if the E1 transmitter underruns. This is only required when Tube Framing is set to transparent and the Telco equipment does not identify a framed All Ones as a BLUE Alarm. Note: Transmit Underruns occur when the IP packets flow is interrupted or stopped.

**OFF** disables generation of an **AIS.**

**Note:** Tube Framing E1 sends an All Ones out the E1 interface in the event of an underrun regardless of this setting.

**E1 DATA {NORMAL | INVERTED}**

Can be set for **Normal** or **Inverted** and must agree with the setting of the DSU/CSU on the other end.

**E1 CLOCKING {NETWORK | INTERNAL | V2PLL | PLL | GPS | OCXO | GPSBackupOCXO }**

Determines the source of Transmit Clock (TxCk). When set to **Network**, the DSU/CSU derives its transmit timing from the received data (RxD). This is also referred to as "Slave" timing.

When set to **Internal**, the DSU/CSU transmits data at a rate set by an internal clock. This mode is referred to as "Master" timing and is often used when testing E1 connections on the bench.

When set to **GPS**, the DSU/CSU transmits data at a rate set by a GPS Antenna. This mode is also referred to as "Master" timing. If using this setting the other unit should be set to "Slave".

When set to **V2PLL or PLL**, the tube tunes its transmit clock to match the rate of the remote tube. When the remote tube clocking is **Internal** or **Network**, this tube should be set to **V2PLL**.

Note: E1 Clocking GPS, OCXO and GPSBackupOCXO is only available for the IP•Tube G4 as an upgradable options.

**E1 FRAMING {CRC4 | FAS | UNFRAMED}**

Selects the desired E1 framing format, including **Unframed**. Note that **Unframed** mode is not permit-

ted with Fractional E1's.

**E1 CODING {HDB3 | AMI}**

Selects whether **HDB3** or **AMI**, (Alternate Mark Inversion), line coding is used.

**E1 IDLECHARACTER 0xNN**

The **E1 IDLECHARACTER** is used with fractional E1 configuration to specify the value for the non selected E1 channels. The purpose of **IDLECHARACTER** is to ensure that CRC4framing's CRC is done without errors. The **Idle Character** setting of the E1 device attached to the Tube's E1 interface needs to be matched when the IP•Tube is set to transport the framing bit **TUBE FRAMING E1 FRAMED** and the E1 interface is **Fractional** and the **E1 Framing** is **CRC4**.

**E1 CHANNELS {FULL | FRACTIONAL {NN XX | {{NN | Y-Z}[,MM | ,Y-Z]}}}**

**FULL** will utilize all channels. When **FRACTIONAL** is selected, additional options are presented.

For fractional E1 with contiguous channels, **NN** is the first E1 channel in use and **XX** is the number of channels to be used.

For example, 384 Kbps fractional E1 typically uses channels 1 through 6. The start channel is 1 and the total channels is 6. where **NN** defines the start channel and **XX** is the total number of channels.

**E1 FRAC 1 6**

Alternatively for channels in use that are not contiguous, **NN** and **MM** are single E1 channels in use and **Y-Z** are a range of E1 channels in use. Single channels and ranges are separated by commas and can be combined on a command line.

For example, an ISDN PRI link uses channels 31 for D Channel signaling and 5-20 for voice circuits

**E1 FRAC 5-20,31**

**E1 Equalization {ON | OFF}**

Enables or disables the Equalizer feature, which provides automatic recieve line sensitivity adjustment. E1 Equalizer should be on when the E1 signal levlel is below 10dB. In general it is fine to have the Equalizer ON for all installations.

**E1 MODE {Term | Monitor}**

Sets the interface mode of E1 interface. Term is used when the E1 interface is the only one connecting to the E1 device.

**Note**: Monitor mode must only be selected for E1 line receiving only on circuits with substantial signal attenuation such as encountered when connecting into a E1 Monitor jack with isolation resistors. Monitor mode is used primarily for signal analysis.

## E1 Echo Canceller

**E1 ECHOCANCELLER {ON | OFF}**

Enables or disables echo cancellation. ECAN is not field upgradable, must be ordered at time of purchase.

**E1 OFFECHOCHANNELS {ALL | NONE | {NN XX | {{NN | Y-Z}[,MM | ,Y-Z]}}}**

Indicates on which channels echo cancellation is disabled.

**ALL** disables all channels echo cancellation.

**NONE** enables all channels echo cancellation.

To selectively disable individual channels, **NN** is the start channel and **XX** is the number of channels to be disabled. Alternatively, **NN** and **MM** are single channels to be disabled and **Y-Z** are a range of channles to be disabled. Single channels and ranges are separated by commas and can be combined on a command line.

Alternatively for channels in use that are not contiguous, **NN** and **MM** are single E1 channels in use and **Y-Z** are a range of E1 channels in use. Single channels and ranges are separated by commas and can be combined on a command line.

For example, an ISDN PRI link uses channel 31 for D Channel signaling thus one would want to disable channel 31 for echo cancellation.

**E1 OFFECHOCHANNELS 31**

## RS530, RS232, X.21 & V.35 Interface

The following Serial Interface commands are applicable to IP•Tube models connecting to RS530, V.35, X.21 and RS232 interfaces.

**TYPE {RS530 | RS232 | V.35 | RS232}**

The **TYPE** parameter is factory configured to match the Serial port's hardware. X.21 is supported using an RS530 to X.21 cable.
Note: When Tube RemoteLoop is on DCD becomes inactive.

**TUBE FPP value**

**Frames-Per-Packet** specifies the number of frames received on the RS-530 or V.35 interface to be encapsulated in a single IP/UDP packet. The size of the serial interface frame depends on the interface provided in the IP•Tube. For the RS-530 and V.35 interfaces, the frame size is 512 bits (64 bytes).

Proper configuration of **FPP** is appplication dependent.

The **SENSEDTRDSR** command is used to configure the RS530, RS232 and V.35 models for connection to their respective communication equipment.
IP•Tube DTR-DSR Sensitivity- AVAILABLE ONLY ON REV. LEVEL 20.85.28 MODELS

The **SENSEDTRDSR** command determines whether the the IP•Tube is sensitive to the DTR signal in the case of IP•Tube DCE or the DSR signal in the case of IP•Tube DTE. When **SENSEDTRDSR** is **ON**, the IP•Tube will send IP packets with encapsulated data only when the DTR, (IP•Tube DCE), or DSR, (IP•Tube DTE), signal is asserted. When **SENSEDTRDSR** is **OFF**, the IP•Tube ignores the DTR or DSR signal and sends IP packets with encapsulated data.

**SENSEDTRDSR {ON | OFF}**

Enable or Disable DTR Sensitivity on a Serial Port for IP•Tube DCE.

Enable or Disable DSR Sensitivity on a Serial Port for IP•Tube DTE.

**DCEDTEMODE {DCE | DTE}**

**DCE** sets the (RS530) serial interface to operate as a Data Communication Equipment that provides the Transmit and Receive clocking.

**DTE** sets the (RS530) serial interface to operate as a Data Terminal Equipment that receives the Transmit and Receive clocking from the RS530 Interface.

Note: Only the RS530 Interface supports the selection of DCE or DTE. The V.35 and the RS232 interfaces need to be ordered as one or the other.

**SCT {NORMAL | INVERTED}**

**SCR {NORMAL | INVERTED}**

The IP•Tube RS-530, RS232 and V.35 models provide DCE, (data communication equipment), or Data Terminal Equipment, (DTE), interfaces. The DCE interface supplies both the Transmit Clock, (serial clock transmit, or **SCT**), and Receive Clock, (**SCR**), to the connected DTE, (date terminal equipment), interface. The IP•Tube RS-530, RS232 and V.35 models allow the user to configure these clocks to **Normal** mode or to **Inverted** mode. The DTE to which the IP•Tube connects may require inverted clock.

**TERMINALTIMING {ON | OFF}**

**ON** enables the (RS530, RS232) serial port receiver to be timed off of the reflected transmit clock

from the DTE, used for high-speed apps, this only works if the serial ports is a DCE.
**OFF** disables the use of the reflected transmit clock

**TERMINALTIMING INVERT {ON | OFF}**

**ON** inverts the logic level of the serial port's reflected transmit clock before clocking the received data, requires that termtiming is **ON**.
**OFF** sets normal logic level for the reflected clock.

**TUBE CLOCK {INTERNAL | PLL}**

The **TUBE CLOCK** command is used to set the source of the Serial Clock Receive and Transmit Timing signals. When **SCRCLOCK** needs to match the **SCTCLOCK** exactly with a smooth non gapped clock, **TUBE INTERVAL = 0**, then one of the IPTUBERS530/V.35s needs to have its **TUBE CLOCK** set to **INTERNAL** and the other needs to be set to **PLL** and **TUBE BUFFER** must be utilized.

**TUBE REMOTECLOCKCONFIG {ON | OFF}**

**ON** enables the Tube's serial port to automatically match the SCR/SCT speed of its partner's serial port. OFF disables automatic detection and relies on the user's configured speeds

**TUBE SCRCLOCK MODE {NX4M | NX5M | NX8M} *Note: High Speed Models only**

These are additional modes available for high speed enabled Tubes, NX4M selects 4 Mbps base frequency, NX5M selects 5 Mbps base frequency, NX8M selects 8 Mbps base frequency, maximum factor allowable is 2 and the Tube SCRclock and SCTclock mode and factor values must be identical. Note: High speed mode requires SCR and SCT clock to be equal.

**TUBE SCRCLOCK MODE {NX2K4 | NX56K | NX64K}**

The **TUBE SCRCLOCKMODE** setting in combination with the **SCRCLOCK FACTOR** controls the frequency of the RS530/V.35 DCE interface's Serial Clock Receive.

**TUBE SCRCLOCK FACTOR value**

**TUBE SCRCLOCK MODE NXxxx** is multiplied by **SCRCLOCK FACTOR** to produce the **SCRCLOCK**.

- NX2K4 2.4k times factor. Maximum factor is 18
  Data rate from 2.4K to 43.2K
- NX56K 56k times factor. Maximum factor is 32
  Data rate from 56K to 1792K
- NX64K 64k times factor. Maximum factor is 32
  Data rate from 64K to 2048K

**TUBE SCRCLOCK FACTOR value DIVIDEBY value**

The **TUBE SCRCLOCK FACTOR** with **DIVIDEBY** added will allow the user to take one of the above possible frequencies and divide it by this factor. The **DIVIDEBY** factor must be an EVEN number. This setting will be applied to BOTH **SCR** and **SCT** clock settings.

- DivideBy Minimum factor is 2
- DivideBy Maximum factor is 32

To turn off the **DIVIDEBY** function, symply do not enter the text after **SCRCLOCK FACTOR value**.

**TUBE SCTCLOCK MODE {NX4M | NX5M | NX8M} *Note: High Speed Models only**

These are additional modes available for high speed enabled Tubes, NX4M selects 4 Mbps base frequency, NX5M selects 5 Mbps base frequency, NX8M selects 8 Mbps base frequency, maximum factor allowable is 2 and the Tube SCRclock and SCTclock mode and factor values must be identical. Note: High speed mode requires SCR and SCT clock to be equal.

**TUBE SCTCLOCK MODE {NX2K4 | NX56K | NX64K}**

The **TUBE SCTCLOCKMODE** setting in combination with the **SCTCLOCKFACTOR** controls the frequency of the RS530/V.35 DCE interface's Serial Clock Transmit.
**TUBE SCTCLOCKFACTOR value**

**TUBE SCTCLOCK MODE NXxxx** is multiplied by **SCTCLOCKFACTOR** to produce the **SCTCLOCK**.

- NX2K4 2.4k times factor. Maximum factor is 18.
  Data rate from 2.4K to 43.2K.
- NX56K 56k times factor. Maximum factor is 32.
  Data rate from 56K to 1792K.
- NX64K 64k times factor. Maximum factor is 32.
  Data rate from 64K to 2048K.

**TUBE INTERVAL value**

**Note: Tube Interval was used in legacy equipment and is left here for informational purposes. It is recommended that Tube Interval be set to 0.**

The **IP•Tube Interval** command is used to control the gapping of the transmit, (SCT), and receive, (SCR), clocks. Permitted values are 0 to 63. An **Interval** of 0 does not gap the clock. An **Interval** consists of the period defined by the Frames Per Packet times the Bytes Per Frame times the bits per byte divided by the **SCxCLOCK** setting. The Bytes Per Frame is set to 64. The **FPP** is user configurable and the bits per byte is 8.

**TUBE INTERVAL** is used to regulate the packet rate. Regulation of the packet rate provides for a mechanism to control the data rate of the IP•Tube RS530/V.35. The **Interval** setting can be utilized to clock data out of the DTE into a packet at its maximum clocking rate so as to minimize latency.

There are 2 methods of controlling the IP•Tube data rate. One method is to set the **SCxCLOCK** rates to the data rate required. This method can double the delay if in the IP•Tube network connection is a WAN link. The other method is to set the **SCxCLOCK** to the DTE's maximum clocking rate and regulate the packet rate with the **Interval** setting.

For an example on how to configure Tube Interval, the user will select Frames-Per-Packet = 10. With this TUBE FPP setting, the tables in Chapter 7 indicate an approximate 7% (ratio is 1.069) overhead. The WAN Point to Point Protocol overhead is off set with the Ethernet MAC addresses not being transported across the WAN link although the HDLC framing does bit stuffing that could bump the data bandwidth by 8%. So the total overhead is 7% for the IP/UDP plus 8% for bit stuffing.

Therefore the desired clock rate on RS530 is 64Kbps/1.15 = 55Kbps. In order to minimize the latency involved in clocking the data from the encrypter's serial interface the encrypter will be clocked at its maximum rate and the Tube Interval setting will be used to hold off clocking the next packet of data until the ISDN WAN router has been able to transmit the prior packet.

To determine the Tube Interval setting take the maximum clocking rate of the DTE divide it by the data rate and subtract one. The encrypter's maximum clocking rate is 2.048Mbps.
Divisor = 2,048,000/55,000 = 37.2.
Round down 2,048,000/37 = 55,351

Note: Slightly greater clocking rate is okay since bit stuffing of 8% is worst case of every data byte being stuffed.
Interval = Divisor minus 1 = 36

Note: The time of clock gapping equals:

((FPP * BytePerFrame* BitsPerByte)/2.048Mbps) times Interval
FPP = 10; BPP = 64; SCRCLOCK = 55,351; Interval = 36
(10 * 64*8)/ 2,048,000 * 36 = 0.09 = 90 milliseconds

This amount of gap can result in synchronization mode limitations. The clock gapping delay can be reduced by reducing the FPP (overhead impact) and the SCTCLOCK base rate (latency impact) which is set to maximum in this example.

**TUBE PERCENTAGE {25 | 50 | 75 | 87 | 100}**

The **TUBE PERCENTAGE** parameter, in conjunction with the **SCxCLOCK MODE/FACTOR**, **TUBE INTERVAL** setting, controls the transmit (SCT) and receive (SCR) clock speeds on the RS-530/V.35 serial interface. A detailed discussion of data bandwidth and clock rate, and how **TUBE FPP**, **TUBE INTERVAL** and **TUBE PERCENTAGE** settings affect them is provided in *Chapter 7: IP•Tube RS-530DL/RS530HS/RS232/X.21/V35/ and IP•Tube SER RS530/RS232/V35*

**X.21 Function**

**Tube X21ControlAndInd {On | Off}**

Turns on or off the sensing of X21 Control and Indication signals

When X21ControlAndInd is on, the state of X21 Control and Indication signals at the local unit are transported to the remote unit and transmitted at the remote interface.

## SER RS530, RS232 and V.35 Specific Configurations

**TUBE SCRCLOCK MODE {NX300 | NX2K4 | NX56K | NX64K | NX100K | NX3P2M}**

The TUBE SCRCLOCK MODE setting in combination with the SCRCLOCK FACTOR controls the frequency of the Serial DCE interface's Serial Clock Receive.

To reduce latency, when NX300 is selected the internal transmit FIFO is reduced from 32 bytes to 1 byte and the receive FIFO is reduced from 4 to 1 byte. Tube BytesPerPacket may be selected in increments of 1 rather than 4.

**TUBE SCRCLOCK FACTOR value**

**TUBE SCRCLOCK MODE NXxxx** is multiplied by **SCRCLOCK FACTOR** to produce the **SCRCLOCK.**

NX300 300 times factor. Maximum factor is 18.
Data rate from 300 to 5.4K.

NX2K4 2.4k times factor. Maximum factor is 18.
Data rate from 2.4K to 43.2K.

NX56K 56k times factor. Maximum factor is 32.
Data rate from 56K to 1792K.

NX64K 64k times factor. Maximum factor is 32.
Data rate from 64K to 2048K.

NX100K 100k times factor. Valid factors are 1, 2, 4 and 8.
Data rate from 100K to 800K.

NX3P2M 3.2M times factor. Valid factors are 1, 2, 4 and 8.
Data rate from 3.2M to 25.6M.

**TUBE SCTCLOCK MODE {NX300 | NX2K4 | NX56K | NX64K | NX100K | NX3P2M}**

The TUBE SCTCLOCK MODE setting in combination with the SCTCLOCK FACTOR controls the frequency of the Serial DCE interface's Serial Clock Transmit.

**TUBE SCTCLOCK FACTOR value**

**TUBE SCTCLOCK MODE NXxxx** is multiplied by **SCTCLOCK FACTOR** to produce the **SCTCLOCK.**

NX300 300 times factor. Maximum factor is 18.
Data rate from 300 to 5.4K.

NX2K4 2.4k times factor. Maximum factor is 18.
Data rate from 2.4K to 43.2K.

NX56K 56k times factor. Maximum factor is 32.
Data rate from 56K to 1792K.

NX64K 64k times factor. Maximum factor is 32.
Data rate from 64K to 2048K.

NX100K 100k times factor. Valid factors are 1, 2, 4 and 8.
Data rate from 100K to 800K.

NX3P2M 3.2M times factor. Valid factors are 1, 2, 4 and 8.
Data rate from 3.2M to 25.6M.

**TUBE BYTESPERPACKET value**

**Bytes-Per-Packet** specifies the number of bytes received on the Serial Interface to be encapsulated in a single IP/UDP packet.

The maximum allowable BytesPerPacket is 1460. The minimum is a function of the clock speed of the line. This is calculated to be (clock speed/32000) + 1 rounded up to a multiple of 4, except in the case of NX300 which can be any number. The BytePerPacket must be a multiple of 4, except in the case of NX300, which can be any number.

Examples:

- 2400bps - Minimum BytesPerPacket 4
- 54Kbps - Minimum BytesPerPacket 4
- 64Kbps - Minimum BytesPerPacket 4
- 100Kbps - Minimum BytesPerPacket 8
- 2.048Mbps (NX64K, Factor 32) - Minimum BytesPerPacket 68
- 12.8Mbps (NX3P2, Factor 4) - Minimum BytesPerPacket 404

**Other Important Calcualtions:**

Calculating IP Packet Delay: (Bytes-Per-Packet * 8) / Frequency

Calculating IP Frequency (per second): 1 / (IP Packet Delay)

Calculating IP Tube Latency (one way): (Bytes-Per-Packet * 8 * Buffers) / Frequency

**Tube RTSextend { On | Off }**
**Tube CTSextend { On | Off }**
**Tube DCDextend { On | Off }**
**Tube DTRextend { On | Off }**
**Tube DSRextend { On | Off }**

The RTS, CTS, DCD, DTR and DSR extend parameters offer psuedo wire extension of these signals. The parameter for a particular signal must be turned On at both the local and remote units. Circuit extension of these signals make sense only when one unit is a DCE unit and the other is a DTE unit. Circuit extension is valid only for Mode Sync and Protocols IPTube and ADPIPTube.

Switch Commands

**PASSTHRU {ON | OFF}**
Passthru **OFF** results in normal IP•Tube operation.
Passthru **ON** switches the S1 port directly to the S2 port. There is no T1/E1 over IP.

**S1 T1/E1 PASSTHRUCLOCK NETWORK|INTERNAL|TEL2**
PassThruClock detefmines the Clocking for a Serial interface when **Passthru** is **ON**. When **Passthru** is **OFF**, the Clocking for a Serial interface is determined by the T1/E1 Clock setting.

Configure T1/E1 **Passthruclock** in the following manner:

Clock Master Connected to the S1 Interface

**Interface S1**

**T1/E1 PassThruClock Network**

**Interface S2**

**T1/E1 PassThruClock Internal**

Clock Master Connected to the S2 Interface or the S1 Interface of a Remote IP•Tube

**Interface S1**

**T1/E1 PassThruClock TEL2**

**Interface S2**

**T1/E1 PassThruClock Network**

IP•Tube as Clock Master
Local IP•Tube Master Clocking

**Interface S1**

**T1/E1 PassThruClock TEL2**

**Interface S2**

**T1/E1 PassThruClock Internal**

Remote IP•Tube

**Interface S1**

**T1/E1 PassThruClock TEL2**

**Interface S2**

**T1/E1 PassThruClock Network**

## Link Protector Commands

**PASSTHRU PROTECTIVE {LINKPROTECTOR | MANUAL}**
When **Passthru Protective** is **MANUAL**, the Link Protector operates in the manner of the T1/E1 Switch Option. Switching between the S2 port and T1/E1 over IP is acheived with **PassThru On** or **Off**.

When **Passthru Protective** is **LINKPROTECTOR**, the LinkProtector option is enabled. Switching between the S2 port and T1/E1 over IP is automatic.

**PASSTHRU PROTECTIVE LINKPROTECTOR {YELLOWALARM | BLUEALARM}**
When **YELLOWALARM** is selected, a Yellow Alarm indication on the S2 port causes a switch to T1/E1 over IP in addition to a Loss of Signal, Loss of Frame, or AIS (Blue Alarm) condition.

When **BLUEALARM** is selected, only Loss of Signal, Loss of Frame, or AIS (Blue Alarm) causes a switch.

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR FAILOVERPERIOD {NNN}**
Time in seconds that LinkProtector evaluates the integrity of the link. Valid range is 1 to 255 seconds.

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR FAILOVERTHRESHOLD {NNN}**
Percentage of errored seconds. If exceeded within the FailoverPeriod this will cause the path to failover to the LAN interface - IPTube protocol. Valid range is 1 to 100 percent

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR FAILBACKPERIOD {NNN}**
Time in seconds - LinkProtector evaluates the integrity of the link. Valid range is 1 to 255 seconds.

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR FAILBACKTHRESHOLD {NNN}**
Percentage of errored seconds - If NOT exceeded within the FailBackPeriod this will cause the path to failback to the S2 interface - PassThru protocol. Valid range is 1 to 100 percent

## Link Protector Alarm Relay Commands

**PASSTHRU PROTECTIVESWITCH LINKPROTECTOR ALARMRELAY**
**{ Off | LANFail | TELFail | LANorTELFail }**
Dependant upon the AlarmRelay setting, the IP•Tube will connect the contacts 1 and 2 of the relay on an alarm. Please see the Table 13 - Alarm Relay Contact in the *Appendix* for more information.

- **OFF** - The AlarmRelay is disabled.
- **LANFail** - The Alarm Relay closes if the unit detects it cannot reach the remote unit over the LAN. This alarm may go off even when the Link Protector status is Up and would be a problem if the unit needed to fail over to TDM over IP. The alarm ceases when IP connectivity to the remote unit is restored.
- **TELFail** - The Alarm Relay closes if the unit detects a link down on the thru TEL interface. It indicates the Link Protector status is in a Local Failed Over or Remote Failed Over state and the unit is passing data via TDM over IP.
- **LANorTELFail** - The Alarm Relay closes if either the LANFail or TELFail alarm is active.

The state of the Alarm Relay can be determined by displaying the output of the **Show Info** command within the global interface. Alarm Relay can be Off (Alarm Inactive) or On (Alarm Active).

**Alarm Relay Off - Reasons:**

- **Configured Off**
- **No Alarm**

**Alamr Relay On - Reasons:**

- **TEL1 LAN Remote Unreachable** - Local unit cannot reach the LAN port of the Tube Destination in S1
- **TEL2 Local Failed** - Local unit lost connectivity to T1
- **TEL2 Remote Failed** - Local unit cannot reach remote unit on TEL2 port
- **TEL3 LAN Remote Unreachable** - Local unit cannot reach the LAN port of the Tube Destination in S3
- **TEL4 Local Failed** - Local unit lost connectivity to T1
- **TEL4 Remote Failed** - Local unit cannot reach remote unit on TEL4 port

**PASSTHRU STATUS:**
Reports the current status of the link. When reporting **PassThru**, data is being sent out the S2 interface. If reports **IP Tube**, data is being sent out the LAN interface.

Example:

```
PassThru ProtectiveSwitch LinkProtector
PassThru ProtectiveSwitch LinkProtector AlarmHandling YellowAlarm
PassThru ProtectiveSwitch LinkProtector FailoverPeriod 10
PassThru ProtectiveSwitch LinkProtector FailoverThreshold 60
PassThru ProtectiveSwitch LinkProtector FailbackPeriod 10
PassThru ProtectiveSwitch LinkProtector FailbackThreshold 40
PassThru ProtectiveSwitch LinkProtector AlarmRelay LANFail
PassThru Status: PassThru
```

The above example shows that on a Yellow Alarm the LinkProtector will Failover to the LAN interface when the integrity of the link has errored 60% or more of the10 second period (6 seconds) and will Failback to the S2 interface when the errors occurs less than 40% of the 10 second period (4 seconds).

For immediate Failover and Failback, set the LinkProtector using the following settings.

```
PassThru ProtectiveSwitch LinkProtector FailoverPeriod 1
PassThru ProtectiveSwitch LinkProtector FailoverThreshold 10
PassThru ProtectiveSwitch LinkProtector FailbackPeriod 1
PassThru ProtectiveSwitch LinkProtector FailbackThreshold 10
```

## Rate Limiter

The IP•Tube GT1/E1 can be configured with a rate limiter feature which controls the flow of packet data from LAN1 to LAN2. The Rate Limiter turns on bridging from LAN1 to LAN2.

**RateLimit {1-20}**

The Rate Limit parameter will set the megabits per second, options are 1 Mbps to 20 Mbps, of output on LAN2 (ONLY). Some devices will be restricted in how many Mbps can be received, such as ADSL or SDSL Routers, and the Tube unit can manage the amount of bandwidth that is allocated to the LAN1 to LAN2 bridge traffic in order to ensure the required bandwidth is available for the TUBE's TDM Over IP.

## SS7 SIGTRAN SNIFFER ETHERREAL Configuration

The IP Tube GT1 SS7 SIG monitors SS7 messaging on a T1 circuit. Each SS7 message is converted to SIGTRAN format. The IP Tube will create an IP/UDP header for the message. The destination address is set in the IP Tube for the IP header. The source address is that of the IP tube itself. This will enable the IP packets to be routed to a remote network where Ethereal can capture the packets for decoding, logging and storage. Packets can be captured based on the source IP, destination IP or

both addresses.

Multi port T1 IP Tubes will also use unique UDP port numbers for each T1.

The SCTP decode within Ethereal will show the DPC and OPC as well as MTP2 and MTP3 data.

To decode the SIGTRAN packets in Ethereal follow these steps:

Click Filter (under the Menu bar and Tool bar).

Type a string (“myfilter_name”) into Filter Name.

Click Expression.

In the popup box Field Name click the “+” next to UDP.

click “udp.dstport”.

click “==”.

In Value type the port number you want (3175 for S1, 3176 for S2...)

Click OK.

Click OK in the Display Filter box.

When the capture is redisplayed, click on a Tube packet.

Click Analyze->Decode As.

Select Decode.

Select Transport->UDP destination 3175.

Select SCTP in the rightmost box.

Click OK.

After redisplay click on Protocol in the top subwindow. Scroll along the packets to find the MTP3MG protocol packets.

In the Source field is the Originating Point Code in hexadecimal, and the Destination field is the Destination Point Code in hexadecimal.

# Chapter 6

## IP•Tube DLT1/DLE1/GT1/GE1/UNO/G4 Configuration & Operation

This chapter provides operational theory and configuration details specific to the IP•Tube DL, G, UNO and G4 models for T1's and E1's. With built-in DSU/CSU interfaces, these models have unique requirements regarding timing, clocking and their interface to other T1/E1 equipment.

Note: The main difference between the IP•Tube DL and IP•Tube G models are as follows:

- IP•Tube DLT1/DLE1 models have two 10/100BaseT interfaces and two serial-ports.
- IP•Tube GT1/GE1 models also have two 10/100BaseT interfaces and use the same configuration for the ports except there are four serial ports available.
- IP•Tube UNO models have either a single 10/100BaseT or 5 10/100BaseT interfaces (four are connected as a switch)

The LAN and Serial interface configuration parameters:

- Autonegotiate On - Interface determines speed and duplex mode.
- Autonegotiate Off - Speed and duplex are set manually.
- Speed - 10Mbps or 100Mbps
- Duplex - half or full.
- BroadcastRCV On - automatically resolves MAC Addresses
- BroadcastRCV Off - Ethernet address can be configured with a MAC address
- ARP On - uses the automatically obtained MAC address
- ARP Off - enables manual MAC address assignment
- Protocol settings - IPTube, CESoIP and HDLCoIP, controls packetization format of the IP•Tube
- Framing - T1/E1 Framed (uses T1/E1 framing bits along with DS0 data) and Transparent, (encapsulates DS0 data with out framing information)
- TOS setting - ensures data is given a high priority
- QoS setting - securely uses configurable UDP port number
- Compression On - on "C" models, enables compression
- E-Can On - provides Echo Cancellation function on some models. ECAN is not field upgradable, must be ordered at time of purchase.
- Clocking - has four different options to clock Internally, from the Network or from another IP•Tube unit, (V2PLL or PLL)

# IP•Tube Installation Steps

The process of installing an IP•Tube DLT1/DLE1/GT1/GE1 involves the following steps:

- Planning for the IP•Tube interconnect
- Installing the IP•Tube hardware
- Configuring System and Ethernet parameters
- Configuring the IP•Tube interface parameters
- Making Ethernet and T1/E1 cabling connections
- Verifying IP•Tube connectivity

Note: A T1/E1 crossover cable is typically required to connect the IP•Tube T1/E1 interface to the external T1/E1 equipment. Direct connections to T1/E1 lines use straight T1/E1 cables.

## System and Ethernet Parameters

The IPTube's System parameters and LAN interface configuration items are described in Chapter 5: *Command Line Interface* for specific syntax requirements. This portion of the manual is dedicated to the installation parameters associated with the T1 and E1 interfaces.

## T1 Parameters

T1 interface commands are configured by first selecting **INTERFACE** S1, (these ports are marked on the IP•Tube as "Tel1", "Tel2", "Tel3", "Tel4").

**INT S1**

The IP•Tube is enabled with the command **TUBE On.**

**TUBE {ON | OFF}**

Tube Framing is configured for **T1 Framed** or **Transparent**:

- **T1 Framed** encapsulates the T1 signaling and framing bits along with the T1 DS0 data. The selection of the T1 DS0s starting channel and number of channels is setup by the Serial Interface's T1 configuration commands.
- **Transparent** framing encapsulates the DS0 data without the T1 framing and signaling bits.

Examples:

**TUBE FRAMING T1 FRAMED**

**TUBE FRAMING TRANSPARENT**

IP•Tube destination address is set to the IP address of the receiving IP•Tube.

Note: Loopback of the T1 occurs when the destination address is the same as the IP address of the Ethernet interface of the IP•Tube.

Example:

**TUBE ADDR 172.16.0.222**

## T1 DSU/CSU Parameters

The IP•Tube T1 serial interface number 1, S1, is configured for T1 operation. The following T1 parameters must match the configuration of the DS1/T1 interface to which it is connected. The T1 clock setting is dependent upon the source of the T1 Clock.

**Interface S1**

Type T1
T1 Mode {Term | Monitor}
T1 Data {Normal | Invert}
T1 Clocking {Internal | Network | V2PLL | PLL | GPS | OCXO | GPSBackupOCXO }
T1 LBO CSU {0dB | -7.5 | -15 | -22.5}
T1 Framing {ESF | D4}
T1 Coding {B8ZS | AMI}
T1 IdleCharacter 0xNN
T1 Speed 64K
T1 Spacing Contiguous
T1 Channels {Full | Fractional: Starting DS0 - Number of DS0s}

Note: When more then one group of channels, not contiguous, hyphens and commas can be used to list all groups, and individual channels.

Note: T1 Clocking GPS, OCXO and GPSBackupOCXO is only available for the IP•Tube G4 as an upgradable options.

## E1 Parameters

The IP•Tube E1 parameters are similar to those for T1 except as noted here:

**TUBE FRAMING {E1FRAMED | TRANSPARENT}**

- E1Framed: encapsulates the framing byte along with the DS0 data.
- Transparent: Only the data in the selected DS0s is transported in the IP•Tube. The E1 framing byte is not encapsulated.

## E1 DSU/CSU Parameters

The following E1 parameters must match the configuration of the E1 interface to which it is connected. The E1 clock setting is dependent upon the source of the E1 Clock.

**Interface S1**

Type E1
E1 Mode {Term | Monitor}
E1 Data {Normal | Invert}
E1 Clocking {Internal | Network | V2PLL | PLL | GPS | OCXO | GPSBackupOCXO }
E1 Framing {CRC4 | FAS|Unframed}
E1 Coding {HDB3 | AMI}
E1 IdleCharacter 0xNN
E1 Channels {Full | Fractional: Starting DS0 - Number of DS0s}

Note: When more then one group or single channels, not contiguous, hyphens and commas can be used to list all groups, and individual channels.

Note: E1 Clocking GPS, OCXO and GPSBackupOCXO is only available for the IP•Tube G4 as an upgradable options.

## T1/E1 Clocking Considerations

Improper configuration of T1/E1 clocking will result in an overrun or underrun condition which causes T1/E1 frame losses. One of the IP•Tube systems must be the "master" clock source or locked onto a T1/E1 clock and the remote end unit uses a **Phase Lock Loop** circuit to match the "master's" T1/E1 clock frequency.

In the case where the IP•Tube systems are being connected to a T1/E1 line from the Telephone company the IP•Tube connected to the Telco T1/E1 must be set to T1/E1 **Clocking Network** and the remote unit set to **Clocking V2PLL**.

V2PLL Stands for Version2 PLL. Version2 PLL has a tighter frequency lock compared to PLL.

The setting **Clocking Internal** is used when no other clock source is available or when the IP•Tube is being tested or configured on a bench.

## Rate Limiter

The IP•Tube GT1/E1 can be configured with a rate limiter feature, check with Engage Communications Sales Department, which will control the flow of data outputted from LAN2. This does not limit the use of LAN 1 but is specific to LAN2 only. Two parameters are new with the Rate Limiter.

**Spanning {On | Off}**

Spanning Tree is a protocol that governs operation of a bridge. If turned On the unit will utilize this protocol.

**RateLimit {1-20}**

The Rate Limit parameter will set the megabits per second, options are 1 Mbps to 20 Mbps, of output on LAN2 (ONLY). Some devices will be restricted in how many Mbps can be received, such as ADSL or SDSL Routers, and the Tube unit can manage the output to coincide with the receiving device.

## TOS, QoS and UDP Port Number

The IP•Tube **TOS** command is used to control the **Type of Service** Byte in the IP packets containing the encapsulated data. The setting of the **TOS** byte can be used to ensure that the real time data from the IP•Tube is accorded high priority as it traverses the IP network. Support for the **TOS** byte is required within each router or switch, making up the interconnect between the IP•Tubes. A **TOS** setting of **0x08** maximizes throughput. Settings for **TOS** range from 0x00 to 0x08.

Note: Tube **TOS** is displayed in hex. Preceding the entry with 0x results in a direct hexidecimal input.

Example:

**TUBE TOS 0x08**

**Note:** It is possible to set the Differentiated Services Code Point (DSCP) field using the TOS value. The Differentiated Services (DiffServ) uses the same byte in the IP Header as the TOS. The 6 MSB of the TOS byte are the same bits used for setting the DSCP value. To enter the Expedited Forwarding (EF) DSCP value enter the following hex value in the TOS field: **0xB8**. This will mark these packets as EF.

**I**ntermediary routers and switches can be configured for **Quality of Service** prioritization to ensure that IP•Tube packets receive highest priority as they are routed through the IP interconnect. This **QoS** could be configured based on the IP•Tube Ethernet IP addresses, but a more straightforward method makes use of the unique UDP port number.

Communication between IP•Tube systems uses packets destined for UDP port number 3175. This registered port assignment, (reference www.iana.org/assignments/port-numbers), allows **QoS** configuration to prioritize UPD packets destined for port 3175.

This prioritization is essential for voice and other traffic which is sensitive to latency and delay on the LAN/WAN interconnection.

## Latency and Bandwidth Considerations

The IP•Tube parameters **TUBE BUFFERS** and **TUBE FPP,** (frames-per-packet), directly correlate with the flow of IP packets on the IP•Tube Ethernet interface. Selection of a large **FPP** value, (resulting in large IP packets), or of a large **TUBE BUFFERS** setting, (resulting in a excessive buffering of received data), will result in significant latency from end to end.

This latency will have a negative impact on delay-sensitive data such as voice, which is severely degraded when round trip delays approach 20 milliseconds.

The following examples provide insight into the various delay mechanisms which can occur if **TUBE BUFFERS** and **TUBE FPP** are configured improperly. Refer to the IP•Tube Delay chart in the *Appendices* for quick calculation.

Example 1:

A T1 frame of 193 bits takes 125 microseconds, (usec), to transmit at 1.544 Mbps. Similarly, an E1 frame of 256 bits takes 125 usec to transmit at 2.048 Mbps.

If a user configures **FPP** to 8, then the IP•Tube introduces a 1 millisecond, (msec), packetization delay as it receives 8 frames and encapsulates them into a single IP packet.

Note: Delay each way must be doubled for the round trip.

**8 x 125 usec = 1 msec delay**

If **TUBE BUFFERS** is then configured to 5, five packets are buffered and the resulting delay is:

**5 x 1msec = 5 msec**

Roundtrip delay would be twice that or 10 msec.

**Example 2**:

The recommended **FPP** setting for E1 is 12, which introduces a 1.5 msec packetization delay:

**12 x 125 usec = 1.5 msec**

If **TUBE BUFFERS** is set to 4, then a 6 msec one-way, or 12 msec roundtrip delay is introduced.

The user should also take into account the latency or delay introduced by the LAN/WAN interconnect to determine total delay.

## IP Packet Encapsulation Overhead

The encapsulation of T1/E1 data into IP/UDP packets for transmission over Ethernet adds overhead due to the Ethernet, IP, and UDP headers - a total of 44 bytes. This 44 byte overhead should be taken into account when considering Ethernet bandwidth utilization.

Notes:

- A DS0 is a 64 Kbps Voice/Data circuit.
- A Full T1 circuit is configured for 24 DS0's. The T1 signal is divided into frames, with one byte, (8 bits), allocated for each configured DS0 and 1 framing bit for a total of 193 bits per frame, (24 x 8) + 1.
- A Full E1 circuit is configured for 31 DS0's. The E1 signal is divided into frames, with one byte, (8 bits), allocated for each configured DS0 and 1 framing/signalling byte, (8 bits), for a total of 32 bytes or 256 bits per frame.

The Tube **FPP** setting controls the number of T1/E1 data frames to be encapsulated in a single IP/UDP packet. If an IP•Tube E1 is configured for **Full** E1 and **FPP** = 1, then the IP packet transmitted out the Ethernet interface will contain 256 bits (32 bytes) of E1 data and 44 bytes of header informa-

tion. This is an inefficient use of Ethernet bandwidth. Increasing **FPP** reduces the effect of this 44 byte overhead.

The encapsulation overhead can be expressed as a ratio of (Data + Overhead)/(Data) and can be used to calculate the Ethernet bandwidth utilization for a given T1/E1 configuration. Example 1 in the *QuickStart* Chapter noted that 1.906 Mbps of Ethernet bandwidth is required when transporting an encapsulated Full 1.544 Mbps T1. This is based on an overhead ratio of 1.234 (or 23.4% overhead).

The formula for the overhead ratio is:

**((((#DSO's x 8) + TubeFraming) x FPP) + 352) / ((#DSO's x 8) x FPP)**

Notes:

- DS0's is the number of 64 Kbps channels configured on T1/E1 interface
- **Tube Framing** is 0 for **Transparent**, 1 for **T1Framed**, 8 for **E1Framed**
- **FPP** is the configured Frames Per packet
- 352 represents the number of bits in the 44 byte overhead
- The formula provides Overhead Ratio. The Overhead Percentage would be (Overhead Ratio - 1)

See the *Appendices* for the overhead ratio of a number of T1/E1 configuration examples, including both Full and Fractional.

## IP•Tube Compression

All of the IP•Tube DL and G models are available with built-in, lossless data compression. When enabled on both the local and the remote IP•Tube units, this feature can achieve a 56:1 compression ratio during periods of idle data on the T1/E1 circuit.

Example:

**TUBE COMPRESSION ON**

## IP•Tube Cabling

The IP•Tubes use standard 10/100BaseT Ethernet cabling to connect to an Ethernet switch or hub. The cabling that is used to connect the IP•Tube T1 Port or E1 Port to the T1/E1 interface to be extended through the Tubes depends upon whether it is connecting to equipment or directly to a T1/E1 line. In the case of a connection to the interface of T1/E1 Equipment a cross over cable is required. Refer to the *Appendices* for the details of the wiring of this cable. Connections to T1 lines is done with a standard T1 cable. An E1 connection utilizes the RJ45 to DB15 male adapter and standard RJ45 cabling with all 8 connections.

## Alarm Relay Contact

The IP•Tube DL and G models are available as an option with a mechanical alarm relay. It can be used to signal when there are problems with communication over the Serial or LAN ports.

# Chapter 7

# IP•Tube RS530DL/RS530HS/RS232/X.21/V.35 and IP•Tube SER RS530/RS232/V.35 Configuration & Operation

This chapter provides operational theory and configuration details specific to the IP•Tube-RS530, RS232 and V.35 models. With the synchronous serial interface connecting to an external encryptor, video codec or router, these models have unique requirements regarding timing and data bandwidth.

## IP•Tube Installation Steps

The process of installing IP•Tube RS530, RS232 or V.35 models involve the following steps:

- Planning for IP•Tube interconnect
- Installing the IP•Tube hardware
- Configuring System and Ethernet parameters
- Making 10/100BaseT Ethernet and RS-530. RS232 or V.35 cabling connections
- Configuring the IP•Tube serial interface parameters
- Making Ethernet connections
- Verifying the IP•Tube connection

### System and Ethernet Parameters

The IPTube's System parameters and LAN interface configuration items are described in Chapter 5: *Command Line Interface* for specific syntax requirements. This portion of the manual is dedicated to the installation parameters associated with the RS530, RS232 and V.35 interfaces.

### Serial Interface Parameters

RS-530, RS232, X.21 and V.35 interface commands are configured by first selecting the Serial Interface, (S1).

Example:

**INT S1**

The IP•Tube RS-530, RS232 and the X.21 interfaces can be configured as a Data Communication Equipment (DCE) or a Data Communication Terminal interface. The V.35 interface must be ordered as a DCE or a DTE.

**TYPE {RS530 | RS232 | V.35 | RS232}**

The **TYPE** parameter is factory configured to match the Serial port's hardware. X.21 is supported using an RS530 to X.21 cable.
Note: When Tube RemoteLoop is on DCD becomes inactive.

**MODE {SYNCHRONOUS | ASYNCHRONOUS}**

Protocol HDLCOIP  The DCE synchronous interface supplies both the Transmit Clock, (SCT) and Receiv

SCR  Normal

SCT  Normal

DCEDTEMode  DCE

Protocol HDLCOIP  The DCE synchronous interface supplies both the Transmit Clock, (SCT) and Receive Clock, SCR) to the connected data terminal equipment, (DTE). The IP•Tube RS-530, RS232, V.35 provides configuration commands to set these two clocks for normal operation or they can be inverted in cases that the DTE to which the IP•Tube connects requires it.
Note: Serial interface does not check for CRC or regenerate CRC when running HDLCOIP.

Example:

**SCR NORMAL**

**SCT NORMAL**

IP•Tube destination address is set to the IP address of the remote IP•Tube.

Example:

**TUBE ADDR 172.16.0.222**

Note: Loopback of the RS-530, RS232 or V.35 data occurs when the destination address is the same as the IP address of the Ethernet interface of the IP•Tube.

The **SENSEDTRDSR** command determines whether the IP•Tube is sensitive to the DTR signal in the case of IP•Tube DCE, or the DSR signal in the case of IP•Tube DTE. When **SENSEDTRDSR** is **ON**, the IP•Tube will send IP packets with encapsulated data only when the DTR, (IP•Tube DCE) or DSR, (IP•Tube DTE) signal is asserted. When **SENSEDTRDSR** is **OFF**, the IP•Tube ignores the DTR or DSR signal and sends IP packets with encapsulated data.

**SENSEDTRDSR {ON | OFF}**

Enable or Disable DTR Sensitivity on a Serial Port for IP•Tube DCE.

Enable or Disable DSR Sensitivity on a Serial Port for IP•Tube DTE.

Note: IP•Tube DTR-DSR Sensitivity is AVAILABLE ONLY  ON  REV. LEVEL 20.85.28 MODELS

## TOS, QoS and UDP Port Number

The IP•Tube **TOS** command is used to control the **Type of Service** Byte in the IP packets containing the encapsulated serial data. The setting of the **TOS** byte can be used to ensure that the real time data from the IP•Tube is accorded high priority as it traverses the IP network. Support for the **TOS** byte is required within each router or switch making up the interconnect between the IP•Tubes. A **TOS** setting of **0x08** maximizes throughput. The range of settings for **TOS** is from 0x00 to 0x08.

Note: Tube **TOS** is displayed in hex. Preceding the entry with **0x** results in a direct hexidecimal input.

Example:

**TUBE TOS  0x08**

Intermediary routers and switches can also be configured for **Quality of Service,** (**QoS**), prioritization to ensure that IP•Tube packets receive highest priority as they are routed through the IP interconnect. This **QoS** could be configured based on the IP•Tube Ethernet IP addresses, but a more straightforward method makes use of the unique UDP port number used by the IP•Tube.

**TUBE UDPPORT value**

**TUBE UDPPORT** specifies the UDP port source and destination address. The IP•Tube only accepts packets that match its UDP Port configuration.

Note: Engage has registered with the IANA, UDP port 3175 decimal. This registered port assignment, (reference www.iana.org/assignments/port-numbers), allows **QoS** configuration to prioritize UDP packets destined for port 3175.

This prioritization is essential for voice and other traffic which is sensitive to latency and delay on the LAN/WAN interconnection.

## Clocking and Bandwidth - IP Tube RS530DL/RS530HS/RS232/X.21/V.35

The IP•Tube RS530, RS232 and IP•Tube V.35 products when configured as Data Communication Equipment, (DCE's), provide the clocking to their attached Data Terminal Equipment, (DTE's). **SCTCLOCK** is used to clock Transmit Data, from the DTE and package them into IP packets that are sent to the interface S1's **TUBE ADDRESS**, (the destination unit). **SCRCLOCK** is used to clock the Receive Data Ethernet packet data from the buffer memory into the DTE.

In order to take into account the variety of desired data rates, bandwidth and latency requirements involved in interconnecting DTE across Ethernet/IP networks the IP•TubeRS530 and IP•TubeV35 clocking options are very flexible.

The latest IP•Tube RS530/RS232/V35s utilize a Core Clock circuit, which can be configured to a fixed frequency or as an adaptive **PLL**, to provide the clocking to independently configurable Serial Clock Receive and Serial Clock Transmit base rate clocks. The Core Clock circuit is set for **Internal** or **PLL** with the **TUBE CLOCK** command.

Example:

**TUBE CLOCK INTERNAL**

The **SCR** and **SCT** base clocks are configured with the **TUBE SCxCLOCK MODE** command which has settings of **NX2K4**, **NX56K**, or **NX64K** and is multiplied by **SCxCLOCK FACTOR** to produce the base **SCxCLOCK**.

- NX2K4 - clock rate from 2.4K to 43.2K as multiples of 2.4k
- NX56K - clock rate from 56K to 1792K as multiples of 56k
- NX64K - clock rate from 64K to 2048K as multiples of 64k
- NX4M - clock rate from 4M to 16M as multiples of 4M
- NX5M - clock rate from 5M to 10M as multiples of 5M
- NX8M - clock rate from 8M to 16M as multiples of 8M

**TUBE SCRCLOCK FACTOR value DIVIDEBY value**

The **TUBE SCRCLOCK FACTOR** with **DIVIDEBY** added will allow the user to take one of the above possible frequencies and divide it by this factor. The **DIVIDEBY** factor must be an EVEN number. This setting will be applied to BOTH **SCR** and **SCT** clock settings.

- DivideBy Minimum factor is 2
- DivideBy Maximum factor is 32

To turn off the **DIVIDEBY** function, symply do not enter the text after **SCRCLOCK FACTOR value**.

Example:

**TUBE SCxCLOCK MODE NX64K**

Since the IP•Tubes are used to interconnect DTEs across Ethernet, which does not provide a common clock, an application appropriate method needs to be used to ensure that the clocking of the data out of one DTE and into the other DTE is not overrun or underrun. Latency and overhead for the connection of data networks needs to be taken into account.

The simplest scenario is when the Tube's Interface protocol selection is **HDLCoIP**, which is used to interconnect data networks, encapsulates the HDLC frames into packets and only requires that the **SCT**s and **SCR**s are configured to the desired data rate. The **TUBE CLOCK** at each end is set to **Internal**, the **TUBE INTERVAL** is set to **0**, **TUBE Percentage** is set to **100**, **TUBE BUFFER** is set to **0**, and the **TUBE FPP** is not used.

Note: HDLC, relevant to the IP•Tube, is the Bit stuffing synchronous serial framing proctocol, HDLC/SDLC, that utilizes the frame delimeter flag 0x7E. HDLC is used to by the Point to Point Protocol, Frame Relay, Cisco's HDLC WAN protocol, and a variety of synchronous serial DTEs.

The interconnect of DTEs that require that every bit is clocked in and out, is supported with the Interface S1 Protocol of IP•Tube and **CESoIP**. One method to make sure that the IP•Tube RS530/V35 does not get overrun is to eliminate buffering delay by having the **SCRCLOCK** set to a slightly higher data rate than the **SCTCLOCK**. The **SCRCLOCK** must not exceed the maximum clocking rate of the DTE. A minor amount of SCR clock gapping will occur. For example, have the **SCRCLOCK FACTOR** one greater than the **SCTCLOCK FACTOR**. This method also tolerates network congestion.

In general only Video Codecs have an issue with gapping of the clocks. WAN routers and Synchronous Encryptors tolerate gapping of the clocks. Encryptors though are sensitive to long clock gaps when they are using time sensitive Synchronization techniques with each other as the start of a synch pattern is received and is timed out if not completed within a certain amount of time.

In the case where **SCTCLOCK** and **SCRCLOCK** must be identical and without gapping, just as presented by the T1/E1 DSU/CSU, then **TUBE BUFFERING** must be used along with having one IP•TUBE RS530/RS232/V35 set to be the clock master, **TUBE CLOCK INTERNAL,** and the other's **TUBE CLOCK** set to **PLL**. The amount of buffering depends upon the worst case Network congestion related inter packet delay. The buffering of Tube packets introduces elasticity that is calculated by taking the number of data bits in each buffered packet, **TUBE FPP** times **Bytes Per Frame**, times the **TUBE BUFFER** setting and dividing this by the **SCRCLOCK**.

Note: The clocking of the data out of the IP•Tube and into the DTE only occurs only when there are bits to be clocked so that an underrun condition is not relevant and clock gapping occurs when there are not any bits in the IP•TUBE Ethernet receive buffer.

**IP•Tube Clock**

The **TUBE CLOCK** command is used to set the source of the Serial Clock Receive and Transmit Timing signals. When **SCRCLOCK** needs to match the **SCTCLOCK** exactly with a smooth non gapped clock, **TUBE INTERVAL = 0**, then one of the IP•TUBE RS530/RS232/V.35s needs to have its **TUBE CLOCK** set to **INTERNAL** and the other needs to be set to **PLL** and the **TUBE BUFFER** needs to be utilized.

**IP•Tube Interval**

**Note: Tube Interval was used in legacy equipment and is left here for informational purposes. It is recommended that Tube Interval be set to 0.**

**TUBE INTERVAL** is used to regulate the IP•TUBE RS530/RS232/V.35's packet rate. Regulation of the packet rate provides for a latency minimizing mechanism to control the data rate of the IP•TUBE RS530/V.35. The **Interval** setting can be utilized to clock data out of the DTE into a packet at its maximum clocking rate, to minimize latency. There are 2 methods of controlling the IP•Tube data rate. One method is to set the **SCxCLOCK** rates to the data rate required and have the **TUBE INTERVAL** set to **0**. This method can double the delay if there is a WAN link in the IP•Tube network connection. Another method is to set the **SCxCLOCK** to the DTE's maximum clocking rate and regulate the packet rate with the **Interval** setting.

**TUBE INTERVAL** should be set to **0** when the IP•TUBE RS530/RS232/V35s are interconnected across an Ethernet/IP network that does not have links with data rates that are significantly below the maximum clocking rate of the DTE. For example with a 10/100BaseT Ethernet interconnect, it is recommended that the **TUBE INTERVAL** be set to **0** and that the **TUBE SCxCLOCK MODE** and **FACTOR** are used to control the clocking of the DTE directly.

The **TUBE INTERVAL** command is used to control the gapping of the **SCTCLOCK** on a packet loading basis. The **SCRCLOCK** should be set to the maximum clocking rate of the DTE. The purpose of the **TUBE INTERVAL** setting is to provide for a method to clock data out of a DTE and into a packet at the maximum data rate and then to wait for the interval of time that allows for the slowest WAN router in the packet's route to send the packet out to it's serial interface before the IP•TUBE sends the next packet. The use of the **TUBE INTERVAL** setting minimizes latency and is great for connecting DTEs across 64kilobit WAN links such as ISDN.

Note: The gapping of the clock is not recommended for Video interconnects and can effect the synchronization modes used by Encryptors. The duration of the off clocking interval is detemined by the number of bytes in the packet which is controlled by the **Frames Per Packet** setting multiplied by the Bytes per frame of 64 times the **TUBE INTERVAL** setting. Shorter off intervals have an adverse effect on overhead.

| Interval | Data Rate(Kbps) |
|---|---|
| 0 | 1,544 |
| 1 | 772 |
| 2 | 515 |
| 3 | 386 |
| 4 | 309 |
| 5 | 257 |
| 6 | 221 |
| 7 | 193 |
| 8 | 172 |
| 9 | 154 |
| 10 | 140 |
| 11 | 129 |
| 12 | 119 |
| 13 | 110 |
| 14 | 103 |
| 15 | 97 |
| 16 | 91 |
| 17 | 86 |
| 18 | 81 |
| 19 | 77 |
| 20 | 74 |
| 21 | 70 |
| 22 | 67 |
| 23 | 64 |

Table 1 - Interval vs. Serial Interface Data Rate with SCTCLOCK set to 1.544Mbps

**IP•Tube Percentage**

The **TUBE PERCENTAGE** parameter, in conjunction with the **SCxCLOCK MODE/FACTOR** and **TUBE INTERVAL** setting, controls the **SCTCLOCK** clocking on the RS-530/RS232/V.35 serial interface. The **TUBE PERCENTAGE** is used to gate the **SCTCLOCK** to reduce the number of clock pulses by 87, 75, 50 and 25 percent. For example the 50% setting blocks every other pulse thus reducing the SCT clock. The use of the percentage setting to achieve a specific data rate is minimized with the **SCxCLOCK MODE/FACTOR** settings that provide for a high resolution base clock frequency configurations.

| Interval | Percentage | Tx Rate (Kbps) |
|---|---|---|
| 0 | 100 | 1,544 |
| 0 | 87 | 1,343 |
| 0 | 75 | 1,158 |
| 0 | 50 | 772 |
| 0 | 25 | 386 |
| 1 | 100 | 772 |
| 1 | 87 | 672 |
| 1 | 75 | 579 |
| 1 | 50 | 386 |
| 1 | 25 | 193 |
| 2 | 100 | 515 |
| 2 | 87 | 448 |
| 2 | 75 | 386 |
| 2 | 50 | 257 |
| 2 | 25 | 129 |
| 3 | 100 | 386 |
| 3 | 87 | 336 |
| 3 | 75 | 290 |
| 3 | 50 | 193 |
| 3 | 25 | 97 |
| 4 | 100 | 309 |
| 4 | 87 | 269 |
| 4 | 75 | 232 |
| 4 | 50 | 154 |
| 4 | 25 | 77 |

Table 2 - Transmit Rate vs. Interval and Percentage

An interval consists of the period defined by the TUBE Frames Per Packet times the Bytes Per Frame times the bits per byte divided by the **SCTCLOCK** setting. The Bytes Per Frame is set to 64. The **TUBE FPP** is user configurable and the bits per byte is 8. Permitted values of **INTERVAL** are 0 to 63. An Interval of 0 does not gap the clock.

**SCR rate = (SCRCLOCK MODE x SCRCLOCK FACTOR x (Percentage/100)) / (Interval+1)**

## Overhead

FPP: The Tube Frames-per-Packet (FPP) setting controls the number of data frames received on the RS530 interface to be encapsulated in a single IP/UDP packet. The IP•Tube segments the data received on the RS530 interface into 64 byte frames. If FPP is set to 1, then all IP packets transmitted out the Ethernet interface will contain 64 bytes of data - relatively small packets.

The user should consider that encapsulation of RS530/RS232/V.35 data into IP packets adds overhead due to the MAC, IP and UDP headers - a total of 44 bytes. This 44 byte overhead should be taken into account when considering Ethernet data rate. The greater the FPP, the less the effect of this overhead.

In many cases it is necessary to limit the rate at which the IP•Tube transmits data on to Ethernet. Table 1 shows the overhead which results from various FPP settings.

Formula: **Overhead = ((FPP*64)+44)/(FPP*64)**

Use table 3 to calculate the overhead contributed by the encapsulation of data into IP packets. From this the user can determine an appropriate rate at which data should be clocked out of the DTE.

| FPP Setting | Serial Data (Bytes) | Ethernet IP Packet Size (Bytes) | Overhead Ratio (Ethernet/Serial) |
|---|---|---|---|
| 1 | 64 | 108 | 1.688 |
| 2 | 128 | 172 | 1.344 |
| 3 | 192 | 236 | 1.229 |
| 4 | 256 | 300 | 1.172 |
| 5 | 320 | 364 | 1.138 |
| 6 | 384 | 428 | 1.115 |
| 7 | 448 | 492 | 1.098 |
| 8 | 512 | 556 | 1.086 |
| 9 | 576 | 620 | 1.076 |
| 10 | 640 | 684 | 1.069 |
| 12 | 768 | 812 | 1.057 |
| 14 | 896 | 940 | 1.049 |
| 16 | 1024 | 1068 | 1.043 |
| 18 | 1280 | 1324 | 1.038 |
| 20 | 1408 | 1452 | 1.034 |

Table 3 - Overhead resulting from various FPP configurations

## Data Rates

**Ethernet Data Rate Example**

If the desired data rate on the Ethernet LAN is 256 Kbps and the user has configured FPP to 12, then the rate at which serial data should be clocked out of the DTE is 256/(1.057) = 242 Kbps.

**RS-530/RS232/X.21/V.35 Data Rate Example**

Alternatively, if the data rate on the serial interface is 256 Kbps and the user has configured FPP at 8, the actual data rate on the ethernet LAN is 256 * 1.086 = 278 Kbps.

**Data Rate and Timing Concerns**

Gaps: Large packets sizes and large interval settings result in significant gaps between IP/UDP packets as they are received by the IP•Tube. These gaps can result in higher level protocol timeouts.

Bit Stuffing Overhead: If the IP/UDP packet will be traversing a WAN link, the possible effect of bit stuffing in the WAN protocol, such as PPP or Frame Relay, can introduce an additional 10% of overhead.

Note: Consider a 256 Kbps satellite link which carries data via the PPP WAN protocol. User should consider the effect of bit stuffing in the PPP encapsulation and reduce the WAN rate by 10% to 230 Kbps.

Latency: Certain traffic types are particularly sensitive to latency - the rountrip delay of data from end to end. The user should take into account the latency or delay introduced by the LAN/WAN interconnect to determine total delay.

**Data Rate for Enhanced Mode the LAN bit rate is calculated as:**

(SCR freq) / 64 / (FPP) * (45 + (64 * (FPP)))

For Example at SCR = 384K and the FPP 1 the data rate is 654000

For Example at SCR = 256K and the FPP 1 the data rate is 436000

# IP•Tube RS530 Notes for X.21 Operation

The IP•Tube RS530 can be used for X.21 communication.

Follow the steps below:

- Modify the S1 configuration
  Set SCR for Normal
  Set SCT for Inverted
- Use custom cable: (See Table Below)
  DB25 male to DB15 (male or female depending on application)
  Connect 'Sig Timing' A and B to both 'Rx and Tx' pins (In Red)
- Set appropiate X.21 Configuration in the S1 interface
  Tube X21ControlAndInd
  OFF - Control and Indicatior signals are not passed through tube
  On - Control and Indicatior signals are passed through tube

| RS530 Signal | RS530 Pin | X.21 Pin | X.21 Signal | Note |
|---|---|---|---|---|
| TxD A | 2 | 2 | TD A | |
| RxD A | 3 | 4 | RD A | |
| DSR A | 6 | 5 | IND A | 'I' Signal |
| Sig Gnd | 7 | 8 | GND | |
| RxCk B | 9 | 13 | Sig Timing B | |
| TxCk B | 12 | 13 | Sig Timing B | |
| TxD B | 14 | 9 | TD B | |
| TxCk A | 15 | 6 | Sig Timing A | |
| RxD B | 16 | 11 | RD B | |
| RxCk A | 17 | 6 | Sig Timing A | |
| DTR A | 20 | 3 | Control A | 'C' Signal |
| DSR B | 22 | 12 | IND B | 'I' Signal |
| DTR B | 23 | 10 | Control B | 'C' Siganl |
| | | | | |
| | | | | |
| Unsued Signals | | | | |
| CTS A | 5 | | | |
| CTS B | 13 | | | |
| DCD A | 8 | | | |
| DCD B | 10 | | | |
| Shield | 1 | | | |

Table 4 - Custom Cable Pin Out for X.21 operation.

# SER RS530/RS232/V.35 Specific Configurations

**SCR {NORMAL | INVERTED}**

The IP•Tube RS-530, RS232 and V.35 models provide DCE, (data communication equipment), or Data Terminal Equipment, (DTE), interfaces. The DCE interface supplies both the Transmit Clock, (serial clock transmit, or SCT), and Receive Clock, (SCR), to the connected DTE, (date terminal equipment), interface. The IP•Tube RS-530, RS232 and V.35 models allow the user to configure these clocks to **Normal** mode or to **Inverted** mode. The DTE to which the IP•Tube connects may require inverted clock.

**NOTE: If the IP Tube is configured as a DTE the SCR may need to be inverted for proper operation.**

**INTERFACE [LAN1 | LAN2 | S1 | S2 | S3 | S4]**

Configuration of the SER RS530, RS232 and V35 models include configuring the device port and the ethernet port. Specify the port to be configred with the command.

**TUBE SCRCLOCK MODE {NX300 | NX2K4 | NX56K | NX64K | NX100K | NX3P2M}**

The TUBE SCRCLOCKMODE setting in combination with the SCRCLOCK FACTOR controls the frequency of the Serial DCE interface's Serial Clock Receive.

To reduce latency, when NX300 is selected the internal transmit FIFO is reduced from 32 bytes to 1 byte and the receive FIFO is reduced from 4 to 1 byte. Tube BytesPerPacket may be selected in increments of 1 rather than 4.

**TUBE SCRCLOCKFACTOR value**

**TUBE SCRCLOCK MODE NXxxx** is multiplied by **SCRCLOCK FACTOR** to produce the **SCRCLOCK.**

- NX300 - clock rate from 300 to 5.4K as multiples of 300
- NX2K4 - clock rate from 2.4K to 43.2K as multiples of 2.4K
- NX56K - clock rate from 56K to 1792K as multiples of 56k
- NX64K - clock rate from 64K to 2048K as multiples of 64K
- NX100K - clock rate from 100K to 800K, valid factors - 1, 2, 4 and 8
- NX3P2M - clock rate from 3.2M to 25.6M, valid factors - 1, 2, 4 and 8

**TUBE SCTCLOCK MODE {NX300 | NX2K4 | NX56K | NX64K | NX100K | NX3P2M}**

The TUBE SCTCLOCKMODE setting in combination with the SCTCLOCKFACTOR controls the frequency of the Serial DCE interface's Serial Clock Transmit.

**TUBE SCTCLOCKFACTOR value**

**TUBE SCTCLOCK MODE NXxxx** is multiplied by **SCTCLOCK FACTOR** to produce the **SCTCLOCK.**

- NX300 - clock rate from 300 to 5.4K as multiples of 300
- NX2K4 - clock rate from 2.4K to 43.2K as multiples of 2.4K
- NX56K - clock rate from 56K to 1792K as multiples of 56k
- NX64K - clock rate from 64K to 2048K as multiples of 64K
- NX100K - clock rate from 100K to 800K, valid factors - 1, 2, 4 and 8
- NX3P2M - clock rate from 3.2M to 25.6M, valid factors - 1, 2, 4 and 8

**TUBE BYTESPERPACKET value**

**Bytes-Per-Packet** specifies the number of bytes received on the Serial Interface to be encapsulated in a single IP/UDP packet.

The maximum allowable BytesPerPacket is 1460. The minimum is a function of the clock speed of the serial interface. This is calculated to be (clock speed/32000) + 1 rounded up to a multiple of 4, except in the case of NX300 which can be any number. The BytePerPacket must be a multiple of 4, except in the case of NX300, which can be any number.

Examples:

- 2400bps - Minimum BytesPerPacket 4
- 54Kbps - Minimum BytesPerPacket 4
- 64Kbps - Minimum BytesPerPacket 4
- 100Kbps - Minimum BytesPerPacket 8
- 2.048Mbps (NX64K, Factor 32) - Minimum BytesPerPacket 68
- 12.8Mbps (NX3P2, Factor 4) - Minimum BytesPerPacket 404

**Other Important Calculations:**

Calculating IP Packet Delay: (Bytes-Per-Packet * 8) / Frequency

Calculating IP Frequency (per second): 1 / (IP Packet Delay)

Calculating IP Tube Latency (one way): (Bytes-Per-Packet * 8 * Buffers) / Frequency

## SER RS232 Asynchronous Specific Configurations

**MODE {SYNCHRONOUS | ASYNCHRONOUS}**

This will configure the RS232 interface for Synchronous or Asynchronous operation.

**NOTE:** Changing this configuration parameter may require a power cycle of the IP Tube.

**SPEED { 1200 | 2400 | 4800 | 9600 | 19200 | 38400 | 64000 }**

Speeds that the SER RS232 supports:

- 1200 baud
- 2400 baud
- 4800 baud
- 9600 baud
- 19200 baud
- 38400 baud
- 64000 baud

**DATABITS { 5 | 6 | 7 | 8 }**

Available configuration for Data Bits.

**STOPBITS { 1 | 2 }**

Supported Stop Bits are 1 and 2.

**PARITY { NONE | EVEN | ODD }**

Available Parity are None, Even and Odd.

## SER PIO Port - Specific Operation

The PIO port is a special port that will transport TTL signal levels. There are four input and four output pins . The status of these signals are monitored and transported across the IP•Tube connection. For example, If IN3 goes LOW at the local location, then the output on the remote IP•Tube of OUT3 will also be LOW. When IN3 changes from a LOW to a HIGH, OUT3 will follow at the remote location.

Pinout of PIO port

- INPUT Pins - 4, 5, 6, 8
- OUTPUT Pins - 14, 15, 16, 17

## RS Control Signal Extension

The RTS, CTS, DCD, DTR and DSR extend parameters offer psuedo wire extension of these signals. The parameter for a particular signal must be turned On at both the local and remote units. Circuit extension of these signals make sense only when one unit is a DCE unit and the other is a DTE unit. Circuit extension is valid only for Mode Sync and Protocols IPTube and ADPIPTube.

**Tube RTSextend { On | Off }**

**Tube CTSextend { On | Off }**

**Tube DCDextend { On | Off }**

**Tube DTRextend { On | Off }**

**Tube DSRextend { On | Off }**

### Debug

When the unit is in DCE mode Interface S1 RX will acculmlate packets if Sense DTR/DSR is set to OFF Interface S1 RX packets will increase even without the serial cable attached.

# Chapter 8

# IP•Tube SER RS530 AutoProtect

This chapter provides operational theory and configuration details specific to the IP•Tube SER RS530 AutoProtect feature.

## Theory of Operation

AutoProtect provides a fully redundant IP•Tube backup between a pair of IP•Tubes. This is done by having Primary and Secondary IP•Tubes at a local location and another Primary and Secondary set at the remote site. Serial data and clocking are provided through a data Y cable to both Primary and Secondary units. Normal operation will happen over the Primary IP•Tubes at the local and remote locations while the Secondary IP•Tubes wait in Standby mode until the Primary units become inactive. The Secondary units will automatically senses when the communication between a pair of Primary IP•Tubes is lost. This is done by using a signaling connection between the Primary and Secondary unit at both locations. Once the Primary units are ready to resume operation the Secondary units will go back into standby mode.

### System and Ethernet Parameters

The IP•Tube's System parameters and LAN interface configuration items are described in Chapter 5: *Command Line Interface* for specific syntax requirements and *Chapter 7: IP•Tube RS-530DL/RS530HS/RS232/X.21/V35/ and IP•Tube SER RS530/RS232/V35*

Configuration & Operation. This portion of the manual is dedicated to the installation parameters associated with the IP•Tube SER RS530 AutoProtect configuration.

### AutoProtect Feature Settings

**AUTOPROTECT { OFF | PRIMARY | SECONDARY }**

This is a Global Interface setting.

When AutoProtect is Off, the AutoProtect feature is not enabled.

When the unit is configured AutoProtect Primary, it is responsible for determining the state of the connection between itself and its peer. When the connection state is good, the Primary signals the Secondary via the signaling cable. The Secondary then "disconnects" from the Serial Data and Clocking Y cable and the Primary "connects".

When the unit is configured AutoProtect Secondary, it checks the Primary state via the signaling cable. If the Primary is powered off or does not have a good connection state with its peer, it gives an Inactive signal to the Secondary which causes the Secondary to "connect" with the Serial Data and Clocking Y cable. When the Secondary receives an Active signal from the Primary, the Secondary "disconnects" from the Serial Data and Clocking Y cable.

NOTE: The Y cables referenced in this section are cables that are delivering the Serial Data and Clocking to **BOTH** IP•Tube SER Primary and Secondary units.

**TUBE CONFIRMREMOTEALIVE { ON | OFF | DONOTTALK}**

Tube ConfirmRemoteAlive must be ON for proper monitoring of the connection state and switching of the Primary link. It still performs its normal functionality but allows the added AutoProtect capability to function. The LAN connections are tested every 10ms with a keep alive heartbeat between the local and remote units.

NOTE: If AutoProtect switches operation to the Secondary units due to loss of LAN connectivity on both LAN ports, Tube ConfirmRemoteAlive will validate that both Serial interfaces (S1 and S2) are transmitting out both serial interfaces before allowing the Primary units to resume operation.

**TUBE CONFIRMREMOTEALIVE TIMEOUT value**

Tube ConfirmRemoteAlive Timeout is a user configurable parameter to determine the time qualification sample period before the Primary fails over to Secondary operation.

Value is in milliseconds and must be in 10ms increments. Valid value range: 10 to 65530 (10ms to 65.530s)

A sample period of 10ms will create the least 'Time To Failover'.

Time to Failover = Tube ComfirmRemoteAlive Timeout * 3

## AutoProtect Signaling Port Settings

The AutoProtect signaling port is performed on the S3 interface. These settings must be set in the serial port used for signaling between the Primary and Secondary units.

**DCEDTEMODE { DCE | DTE }**

If the IP•Tube is to be configured as a Primary unit, DCEDTEMode must be set for **DCE**.

If the IP•Tube is to be configured as Secondary unit, DCEDTEMode must be set for **DTE**.

These settings must be correct for proper operation of the AutoProtect feature.

There are two Y cables used to connect to the Primary and Secondary units. Connect one Y cable using the DB60 connector to the Primary units S3/S4 port. Then connect the second Y cable using the DB60 to the Secondary units S3/S4 port. Next connect both Y cables using a Female to Female Gender Changer connecting the Y cable ends of DB25_1 of the Primary to the DB25_1 of the Secondary. This will connect the Primary and Secondary AutoProtect signal to each other.

NOTE: The Y cables referenced in this section are cables used to access ports S3 and S4 on the IP•Tube SER product. These cables are used for signaling only.

# Chapter 9

# IP•Tube T3 Configuration & Operation

This chapter provides operational theory and configuration details specific to the IP•Tube T3 model with Firmware Version **64.72.xx**. To verify Firmware Version, login to unit and type 'show router'.

## IP•Tube Installation Steps

The process of installing an IP•Tube T3 involves the following steps:

- Planning for the IP•Tube interconnect
- Installing the IP•Tube hardware
- Configuring System and Ethernet parameters
- Configuring the IP•Tube interface parameters
- Making Ethernet and T3 cabling connections
- Verifying IP•Tube connectivity

### System and Ethernet Parameters

The IPTube's System parameters and LAN interface configuration items are described in Chapter 5: *Command Line Interface* for specific syntax requirements. This portion of the manual is dedicated to the installation parameters associated with the T3 interface.

### T3 Parameters

The IP•Tube T3 does not have any T3 related configuration parameters. All the data bits of the T3 are put transparently into the Tube's IP packets. The IPTubeT3 supports all T3 Framing and Coding configurations.

### T3 Clocking Considerations

Improper T3 clocking will result in an overrun or underrun condition which causes T3 frame losses. There are two different clocking schemes.

The first configuration would have the local unit set for **Internal** clocking and the remote unit **PLL**. This solution would be used if the IP•Tube solution is needed to provide clocking for the circuit (Master Circuit Clock). The unit set for **Internal** would be providing the Master Clock and the other unit set for **PLL** to provide clocking for the remote end. The equipment connected to the IP•Tubes would need to be set to receive clocking from the IP•Tubes.

The second setup would require one IP•Tube set for **Network** clocking and the remote unit **PLL**. This solution is required when an IP•Tube needs to receive clocking from the equipment connected to the T3 interface (Master Circuit Clock). The unit set for **Network** would be receive clocking from the T3 interface and pass it along to the remote unit which would be set for **PLL** to pass clocking to the equipment that is connected to. The equipment connected to the **Network** IP•Tube would need to generate clocking and the equipment connected to the **PLL** unit needs to be set to receive clocking.

**T3 CLOCKING {INTERNAL | NETWORK | PLL}**

Determines the source of Transmit Clock (TxCk).

When set to **Internal**, the DSU/CSU transmits data at a rate set by an internal oscillator. This mode is referred to as "Master" timing and is used when testing on the bench - One unit set to "Master", the other to "Slave". It can also be used as a Master Clock for the T3 circuit if needed.

When set to **Network**, the DSU/CSU receives clocking from the TEL1 interface and uses it for clocking the Transmit Data. It is also passed on to the remote unit set for **PLL**.

When set to **PLL**, the tube tunes its transmit clock to match the rate of the local tube. Passing it on to the equipment it is connected to.

Example:

interface s1
t3 clocking internal
save
y

## Latency and Bandwidth Considerations

The IP•Tube T3 has an adjustable setting to accommodate for Network jitter. **TUBE BUFFERS** will set the amount of jitter tolerance the IP•Tube will be able to handle on the Network. The values are entered in milliseconds. A **TUBE BUFFERS** value of 5 represents 5 ms of buffering, a value of 8 would be 8 ms of buffering. The minimum and maximum values are **3** to **11**. This setting should match on both units. The round trip delay can be calculated by multiplying the **TUBE BUFFERS** value by 2.

The IP•Tube has a fixed parameter for **TUBE FPP,** (frames-per-packet, not displayed in the configuration). The 8,000 bits of T3 are loaded into IP packet that is IP addressed and sent to the other IPTube T3 where these bits are buffered.

Example:

interface s1
tube buffers 8
save
y

## IP Packet Encapsulation Overhead

The encapsulation of T3 data into IP/UDP packets for transmission over Ethernet adds overhead due to the Ethernet, IP, and UDP headers - a total of 44 bytes. This 44 byte overhead is a very small percentage of the 1000 byte packet payload that it does not need to be taken into account when considering Ethernet bandwidth utilization. The IPTubeT3 utilizes 5% more than the T3 clock rate of 44.736 Megabits of the Packet network.

## IP•Tube Cabling

**LAN**

The IP•Tubes use standard 10/100BaseT Ethernet cabling to connect to an Ethernet switch.

**T3**

The T3 uses 75 ohm coaxial connectors for the Transmit and Receive signals. Transmit is the ouput and Receive is the input.

## T3 Status LEDs

In addition to the standard LEDs for the serial interface, there are three additional LEDs for the T3.

ALOS - Analog Loss of Signal - When the incoming T3 signal falls below the acceptable threshold level.

DLOS - Digital Loss of Signal - Occurs when a string of 175 consecutive zeros occur on the line.

RLOL - Receive Loss of Lock - When the receiver has detected a loss of lock condition.

T3 EXAMPLE CONFIGURATION - (Firmware **64.72.xx**)

**## UNIT 1**

IP Default-router 255.255.255.255

Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

Interface LAN1
Autonegotiation On
8021q Off

DHCPClient Off
IP Address 192.168.1.50/24
IP Default-router
Port On
BroadcastRcv On
IP State: RUNNING
DDNS Off
OurDomainName

Interface LAN2
Autonegotiation On
8021q Off

DHCPClient Off
IP Address 192.168.2.50/24
IP Default-router
Port On
BroadcastRcv On
IP State: RUNNING
DDNS Off
OurDomainName

Interface S1
Type T3
Protocol IPTube
Tube Name
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube ConfirmRemoteAlive On
Tube LANPort LAN1
Tube 1 DynamicAddress Off
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3175
Tube 1 TOS 0xB8
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
Tube Buffers 5
Tube Duplicates 0

T3 Clocking PLL

```
## UNIT 2

IP Default-router 255.255.255.255

Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

Interface LAN1
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.1.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface LAN2
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.2.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface S1
 Type T3
 Protocol IPTube
 Tube Name
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube ConfirmRemoteAlive On
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Buffers 5
 Tube Duplicates 0

 T3 Clocking             Internal
```

# Legacy IP•Tube T3 Configuration & Operation

This chapter provides operational theory and configuration details specific to the IP•Tube T3 model with Firmware Version **39.72.xx**. To verify Firmware Version, login to unit and type 'show router'.

## IP•Tube Installation Steps

The process of installing an IP•Tube T3 involves the following steps:

- Planning for the IP•Tube interconnect
- Installing the IP•Tube hardware
- Configuring System and Ethernet parameters
- Configuring the IP•Tube interface parameters
- Making Ethernet and T3 cabling connections
- Verifying IP•Tube connectivity

### System and Ethernet Parameters

The IPTube's System parameters and LAN interface configuration items are described in Chapter 5: *Command Line Interface* for specific syntax requirements. This portion of the manual is dedicated to the installation parameters associated with the T3 interface.

### T3 Parameters

The IP•Tube T3 does not have any T3 related configuration parameters. All the data bits of the T3 are put transparently into the Tube's IP packets. The IPTubeT3 supports all T3 Framing and Coding configurations.

### T3 Clocking Considerations

Improper T3 clocking will result in an overrun or underrun condition which causes T3 frame losses. The IP•TubeT3's Transmit clocking is fixed at **Phase Lock Loop. One of the T3 devices connected to the IPTubeT3's needs to have its clocking configured for internal.**

### Latency and Bandwidth Considerations

The IP•Tube has fixed parameters for the **TUBE BUFFERS** and **TUBE FPP,** (frames-per-packet). The 8,000 bits of T3 are loaded into IP packet that is IP addressed and sent to the other IPTube T3 where these bits are buffered. The buffering provides 2 milliseconds of elasticity to accomodate Ethernet Jitter.

### IP Packet Encapsulation Overhead

The encapsulation of T3 data into IP/UDP packets for transmission over Ethernet adds overhead due to the Ethernet, IP, and UDP headers - a total of 44 bytes. This 44 byte overhead is a very small percentage of the 1000 byte packet payload that it does not need to be taken into account when consid-

ering Ethernet bandwidth utilization. The IPTubeT3 utilizes 5% more than the T3 clock rate of 44.736 Megabits of the Packet network.

## IP•Tube Cabling

**LAN**

The IP•Tubes use standard 10/100BaseT Ethernet cabling to connect to an Ethernet switch.

**T3**

The T3 uses 75 ohm coaxial connectors for the Transmit and Receive signals. Transmit is the ouput and Receive is the input.

LEGACY - T3 EXAMPLE CONFIGURATION - (Firmware **39.72.xx**)

**## UNIT 1**

IP Default-router 255.255.255.255

Tube Capability On

Telnet On
UserTimeout Off

SNMP Off
SNMP Traps Off

Interface LAN1
Auto Negotiation: On
IP Address 192.168.3.50/24
IP Default-router
Port On
BroadcastRcv On
IP State: RUNNING

Interface T3
Type T3
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube LANPort LAN1
Tube 1 Destination 192.168.3.51
Tube 1 UDPPORT 3175
Tube 1 TOS 08 Hex
Tube Duplicates 0
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 00:00:00:00:00:00
Tube SequenceRecovery Off
T3 Clocking PLL

# Chapter 10

# IP•Tube E3 Configuration & Operation

This chapter provides operational theory and configuration details specific to the IP•Tube E3 model with Firmware Version **64.72.xx**. To verify Firmware Version, login to unit and type 'show router'.

## IP•Tube Installation Steps

The process of installing an IP•Tube E3 involves the following steps:

- Planning for the IP•Tube interconnect
- Installing the IP•Tube hardware
- Configuring System and Ethernet parameters
- Configuring the IP•Tube interface parameters
- Making Ethernet and E3 cabling connections
- Verifying IP•Tube connectivity

### System and Ethernet Parameters

The IPTube's System parameters and LAN interface configuration items are described in Chapter 5: *Command Line Interface* for specific syntax requirements. This portion of the manual is dedicated to the installation parameters associated with the E3 interface.

### E3 Parameters

The IP•Tube E3 does not have any E3 related configuration parameters. All the data bits of the E3 are put transparently into the Tube's IP packets. The IPTubeE3 supports all E3 Framing and Coding configurations.

### E3 Clocking Considerations

Improper E3 clocking will result in an overrun or underrun condition which causes E3 frame losses. There are two different clocking schemes.

The first configuration would have the local unit set for **Internal** clocking and the remote unit **PLL**. This solution would be used if the IP•Tube solution is needed to provide clocking for the circuit (Master Circuit Clock). The unit set for **Internal** would be providing the Master Clock and the other unit set for **PLL** to provide clocking for the remote end. The equipment connected to the IP•Tubes would need to be set to receive clocking from the IP•Tubes.

The second setup would require one IP•Tube set for **Network** clocking and the remote unit **PLL**. This solution is required when an IP•Tube needs to receive clocking from the equipment connected to the E3 interface (Master Circuit Clock). The unit set for **Network** would be receive clocking from the E3 interface and pass it along to the remote unit which would be set for **PLL** to pass clocking to the equipment that is connected to. The equipment connected to the **Network** IP•Tube would need to generate clocking and the equipment connected to the **PLL** unit needs to be set to receive clocking.

**E3 CLOCKING {INTERNAL | NETWORK | PLL}**

Determines the source of Transmit Clock (TxCk).

When set to **Internal**, the DSU/CSU transmits data at a rate set by an internal oscillator. This mode is referred to as "Master" timing and is used when testing on the bench - One unit set to "Master", the other to "Slave". It can also be used as a Master Clock for the E3 circuit if needed.

When set to **Network**, the DSU/CSU receives clocking from the TEL1 interface and uses it for clocking the Transmit Data. It is also passed on to the remote unit set for **PLL**.

When set to **PLL**, the tube tunes its transmit clock to match the rate of the local tube. Passing it on to the equipment it is connected to.

Example:

interface s1
e3 clocking internal
save
y

## Latency and Bandwidth Considerations

The IP•Tube E3 has an adjustable setting to accommodate for Network jitter. **TUBE BUFFERS** will set the amount of jitter tolerance the IP•Tube will be able to handle on the Network. The values are entered in milliseconds. A **TUBE BUFFERS** value of 5 represents 5 ms of buffering, a value of 8 would be 8 ms of buffering. The minimum and maximum values are **3** to **15**. This setting should match on both units. The round trip delay can be calculated by multiplying the **TUBE BUFFERS** value by 2.

The IP•Tube has a fixed parameter for **TUBE FPP,** (frames-per-packet, not displayed in the configuration). The 8,000 bits of E3 are loaded into IP packet that is IP addressed and sent to the other IPTube E3 where these bits are buffered.

Example:

interface s1
tube buffers 8
save
y

## IP Packet Encapsulation Overhead

The encapsulation of E3 data into IP/UDP packets for transmission over Ethernet adds overhead due to the Ethernet, IP, and UDP headers - a total of 44 bytes. This 44 byte overhead is a very small percentage of the 1000 byte packet payload that it does not need to be taken into account when considering Ethernet bandwidth utilization. The IPTubeE3 utilizes 5% more than the E3 clock rate of 34.368 Megabits of the Packet network.

## IP•Tube Cabling

**LAN**

The IP•Tubes use standard 10/100BaseT Ethernet cabling to connect to an Ethernet switch.

**E3**

The E3 uses 75 ohm coaxial connectors for the Transmit and Receive signals. Transmit is the ouput and Receive is the input.

## E3 Status LEDs

In addition to the standard LEDs for the serial interface, there are three additional LEDs for the E3.

ALOS - Analog Loss of Signal - When the incoming E3 signal falls below the acceptable threshold level.

DLOS - Digital Loss of Signal - Occurs when a string of 175 consecutive zeros occur on the line.

RLOL - Receive Loss of Lock - When the receiver has detected a loss of lock condition.

E3 EXAMPLE CONFIGURATION - (Firmware **64.72.xx**)

**## UNIT 1**

IP Default-router 255.255.255.255

Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

Interface LAN1
Autonegotiation On
8021q Off

DHCPClient Off
IP Address 192.168.1.50/24
IP Default-router
Port On
BroadcastRcv On
IP State: RUNNING
DDNS Off
OurDomainName

Interface LAN2
Autonegotiation On
8021q Off

DHCPClient Off
IP Address 192.168.2.50/24
IP Default-router
Port On
BroadcastRcv On
IP State: RUNNING
DDNS Off
OurDomainName

Interface S1
Type E3
Protocol IPTube
Tube Name
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube ConfirmRemoteAlive On
Tube LANPort LAN1
Tube 1 DynamicAddress Off
Tube 1 Destination 192.168.1.51
Tube 1 UDPPORT 3175
Tube 1 TOS 0xB8
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 000000000000
Tube Buffers 5
Tube Duplicates 0

E3 Clocking PLL

```
## UNIT 2

IP Default-router 255.255.255.255

Telnet On

UserTimeout Off

SNMP Off
SNMP Traps Off

Interface LAN1
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.1.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface LAN2
 Autonegotiation  On
 8021q Off

 DHCPClient Off
 IP Address 192.168.2.51/24
 IP Default-router
 Port On
 BroadcastRcv On
 IP State: RUNNING
 DDNS Off
 OurDomainName

Interface S1
 Type E3
 Protocol IPTube
 Tube Name
 Tube On
 Tube Localloop Off
 Tube Remoteloop Off
 Tube ConfirmRemoteAlive On
 Tube LANPort LAN1
 Tube 1 DynamicAddress Off
 Tube 1 Destination 192.168.1.50
 Tube 1 UDPPORT  3175
 Tube 1 TOS  0xB8
 Tube 1 Ethernet Arp On
 Tube 1 Ethernet Address 000000000000
 Tube Buffers 5
 Tube Duplicates 0

 E3 Clocking             Internal
```

# LEGACY IP•Tube E3 Configuration & Operation

This chapter provides operational theory and configuration details specific to the IP•Tube E3 model with Firmware Version **39.72.xx**. To verify Firmware Version, login to unit and type 'show router'.

## IP•Tube Installation Steps

The process of installing an IP•Tube E3 involves the following steps:

- Planning for the IP•Tube interconnect
- Installing the IP•Tube hardware
- Configuring System and Ethernet parameters
- Configuring the IP•Tube interface parameters
- Making Ethernet and E3 cabling connections
- Verifying IP•Tube connectivity

### System and Ethernet Parameters

The IPTube's System parameters and LAN interface configuration items are described in Chapter 5: *Command Line Interface* for specific syntax requirements. This portion of the manual is dedicated to the installation parameters associated with the E3 interface.

### E3 Parameters

The IP•Tube E3 does not have any E3 related configuration parameters. All the data bits of the E3 are put transparently into the Tube's IP packets. The IPTubeE3 supports all E3 Framing and Coding configurations.

### E3 Clocking Considerations

Improper E3 clocking will result in an overrun or underrun condition which causes E3 frame losses. The IP•TubeE3's Transmit clocking is fixed at **Phase Lock Loop. One of the E3 devices connected to the IPTubeE3's needs to have its clocking configured for internal.**

### Latency and Bandwidth Considerations

The IP•Tube has fixed parameters for the **TUBE BUFFERS** and **TUBE FPP,** (frames-per-packet). The 8,000 bits of E3 are loaded into IP packet that is IP addressed and sent to the other IPTube E3 where these bits are buffered. The buffering provides 2 milliseconds of elasticity to accomodate Ethernet Jitter.

### IP Packet Encapsulation Overhead

The encapsulation of E3 data into IP/UDP packets for transmission over Ethernet adds overhead due to the Ethernet, IP, and UDP headers - a total of 44 bytes. This 44 byte overhead is a very small percentage of the 1000 byte packet payload that it does not need to be taken into account when considering Ethernet bandwidth utilization. The IPTubeE3 utilizes 5% more than the E3 clock rate of 34.368 Megabits of the Packet network.

## IP•Tube Cabling

**LAN**

The IP•Tubes use standard 10/100BaseT Ethernet cabling to connect to an Ethernet switch.

**E3**

The E3 uses 75 coaxial connectors for the Transmit and Receive signals. Transmit is the ouput and Receive is the input.

LEGACY - E3 EXAMPLE CONFIGURATION - (Firmware **39.72.xx**)

**## UNIT 1**

IP Default-router

Tube Capability On

Telnet On
UserTimeout Off

SNMP Off
SNMP Traps Off

Interface LAN1
Auto Negotiation: On
IP Address 192.168.3.50/24
IP Default-router
Port On
BroadcastRcv On
IP State: RUNNING

Interface E3
Type E3
Protocol IPTube
Tube On
Tube Localloop Off
Tube Remoteloop Off
Tube LANPort LAN1
Tube 1 Destination 192.168.3.51
Tube 1 UDPPORT 3175
Tube 1 TOS 08 Hex
Tube Duplicates 0
Tube 1 Ethernet Arp On
Tube 1 Ethernet Address 00:00:00:00:00:00
Tube SequenceRecovery Off

# Chapter 12

# Troubleshooting

Communication and Network systems are subject to issues from a variety of sources. Fortunately, an organized troubleshooting approach usually leads to the area of the problem in short order. It is essential to distinguish between problems caused by the LAN, (network system), the WAN, (communication equipment), the T1/E1 Equipment and the IP•Tube configuration.

This troubleshooting chapter is structured with symptoms in the order the user might encounter them.

## Unable to Communicate with the IP•Tube

Installations first require communication with the IP•Tube, usually from the same network as the IP•Tube itself. Proceed through the following symptoms if you are unable to communicate with the local IP•Tube using Telnet, Ping, etc. IP Addressing should be double checked.

## Ethernet/General

Cause:  Network Cabling is faulty

Solution: Verify cabling is good by swapping IP•Tube cabling with a known good connection. Check the status LEDs on the 10/100BaseT switch to confirm a good connection. If necessary, create a stand-alone LAN with just the workstation and the IP•Tube.

## High Ethernet Error Count

Cause: Bad cabling or building wiring

Solution: Check all cabling. Swap to known good port on 10/100BaseT hub to troubleshoot, (testing with large Ping Packets to ascertain quality of Ethernet Connection). To eliminate issues with building wiring connect the IP•Tube with a known good Ethernet cable in the same room as the Ethernet hub.

Cause: Can not connect to a hub at 100 Mbps with autonegotiate turned on. Connection drops to 10 Mbps at half duplex.

Solution: For **Models GT1/GE1 only,** change LAN1 interface to match the hub configuration.

## Can’t Communicate/Telnet with IP•Tube - TCP/IP

Cause:  IP address is not set properly on the IP•Tube

Solution: The Console Port, which requires an RJ45 to DB9 adapter, provides direct access to the configuration of the IP•Tube.

Note: The RJ45 Cable that connects to the Console Port must have 8 connections pinned 1 to 1, (Typical Ethernet cables are only 4 wires). The Console port utilizes the Command Line Interface, detailed in Chapter 5: *Command Line Interface*, and the *Appendices*. Interface E1's IP Address must be in the subnet of the computer that is attempting to access it locally.

Cause: Workstation not on the same subnet as the IP•Tube

Solution: During an initial configuration of an IP•Tube, communication should come from within the same network or subnet. With no default router, the IP•Tube will not be able to reply to communication off its own subnet.

Cause: IP stack on the workstation not configured

Solution: Ensure that other devices on the same LAN can be pinged, or otherwise 'seen'.

### Can’t communicate to the IP•Tube - Console Port

Cause: Baud Rate, Stop Bits, etc. set wrong on communication application

Solution: Ensure the communication software is configured for a fixed, asynchronous data rate of **9600 bps, 1 stop bit, no parity, 8 bit fixed and that the Flow control is set to none.**

Cause: Transmit and Receive Data swapped

Solution: The console port is configured as a DCE, (data communication equipment), port. For connection to other DCE devices, such as a modem, a Null Modem adapter is required.

Note: the RJ45 Cable that connects to the Console Port must have 8 connections pinned 1 to 1 (Typical Ethernet cables are only 4 wires). RJ45 to DB9 adapter The RJ45 to DB9 adapter included performs the Null Modem function.

## T1/E1 Circuit Extension to Remote IP•Tube not Functioning

### Local IP•Tube Port 1 LED Remains Blank

All equipment has been configured and connected, and the T1/E1 equipment has been "turned up", yet the port 1 LED remains blank, rather than turning Green. Green indicates reception of T1/E1 frames, from the T1/E1 Equipment attached to Port 1's T1-1/E1-1 interface, that matches the T1/E1 framing protocol configuration of IP•Tube: T1 - ESF or D4, E1 - CRC4 or FAS. Port 1 will turn green independent of the configuration of the network parameters and whether the number of DS0s matches. E1 requires that the line coding match also. E1 HDB3 line coding is recommended.

Proceed through the following steps in sequence:

### IP•Tube Cabling

The cabling that is used to connect the IP•Tubes depends upon whether it is connecting to equipment or directly to a T1/E1 line. In the case of a connection to the T1/E1 interface of T1/E1 Equipment a T1/E1 cross over cable is required. For E1 connections the cross over cable is used between the RJ45 connector on the IPTube and the RJ45 to DB15 Male adapter. Refer to the Appendices for the details of the wiring of this cable. Connections to a T1/E1 line is done with a standard RJ45 cable (8 straight 1 to 1).

## Interface S1 Configuration

Interface S1, (TEL1), must have its Type set to T1 or E1, Tube On, Protocol set to IPTube.

### IP•Tube T1 Interface Framing

Port 1 Green indicates reception of T1/E1 frames, from the T1/E1 Equipment attached to Port 1's T1/E1 interface, that matches the T1/E1 framing protocol configuration of IP•Tube: T1 - ESF or D4 : E1 - CRC4 or FAS and E1 Coding - HDB3 or AMI. Port 1 will turn green independent of the configuration of the network parameters and whether the number of DS0s matches.

## Local IP•Tube Port 1 LED Green But T1/E1 Circuit Extension not working

**IP•Tube T1/E1OverIP Interface Loopback**

A method to locally loopback the T1/E1 over IP interface back to itself in order to test the configuration of the T1/E1 Equipment and Interface S1 and the cabling (Port 1 Green Indicator does not verify Transmit signal connection from the IP•Tube to the T1/E1 Equipment/Line), is to set the Tube's destination IP Address to be the same as the IP Address of the Ethernet Interface. During this test to insure that interference is not occurring from an IP•Tube that is pointed to the IP•Tube placed in loopback, make sure that all known IP•Tubes that could be streaming T1/E1OverIP packets to it are turned off.

The T1/E1 equipment should then detect that it is receiving what it is sending. A T1/E1 test set could be used to stream a test pattern into Interface S1 for testing. Basic T1/E1 Test sets do not have fractional T1/E1 configuration and the IP•Tube may need to be set to Full T1/E1 on its interface S1 to thoroughly test the connection. A typical problem with T1/E1 circuit extension is the misconfiguration of the Fractional T1/E1 DS0s.

If the T1/E1 over IP Interface Local Loopback works marginally, (data bit errors are occurring), the T1/E1 clock settings of the T1/E1 Equipment and the IP•Tube's T1/E1 interface must be set up to a master/slave relationship. For example the T1/E1 Equipment should be set to Network Timing and the IP•Tube's T1/E1 clock should be set to Internal timing.

## IP•Tube IP Interconnect Verification

The most straight forward way to test the T1/E1 Circuit extension of the IP•Tubes is to have them connected into the same Ethernet Hub with unique IP addresses that are within the same subnet. For example set one of the IP•Tubes to 192.168.1.1 and the other to 192.168.1.2.

Note: Once an IP•Tube has determined the Mac Ethernet Address of the remote unit, it requires a reset to obtain the Mac Ethernet Address of a substitute unit.

## IP•Tube Off Net IP Interconnect Verification

In most applications the IP•Tubes will be located on different IP networks and the interconnection is through a routed connection. At each end of the routed connection the IP•Tube's default router IP address needs to be pointed to the first router in the path to that remote IP subnet. Through a Telnet connection to an IP•Tube it is possible to verify the ability of the IP•Tube to ping its local default router and to ping the remote IP•Tube.

Note: The console port does not support the Ping Command as it does not have an IP Address.

## Show Statistics

The CLI command SHOW STATISTICS provides a way to check whether the T1OverIP port is receiving T1 frames on its Port interface and transmitting them out its Ethernet interface. Also reception of packets on its Ethernet interface and transmission out is Port 1 interface can be checked. Repeatedly issuing the command SHOW STATISTICS, (short hand SH ST), can help determine the source of a problem.

For example, errors with the Ethernet interface reception of packets will slow or stop the Port interface transmission of packets. Errors with Port interface reception of packets will slow or stop the expected rate of the Ethernet interface transmission of packets.

Certain statistics can indicate clocking problems. Port interface Transmit underruns, (UN), indicate the interface ran out of packets to transmit. If the Ethernet interface is running without errors, then this might indicate the transmit clock on this tube is running faster than the remote tube is clocking reception of data on its port interface.

Transmit DrainDrops indicate the number of packets dropped by the IP•Tube after Ethernet interface reception because too many buffers are queued on the port interface.

The number of buffers queued are indicated by Transmit Buffer Queue.

**Depth**

If Transmit Buffer Queue Depth is increasing beyond the configured Tube Buffers and Transmit Drain Drops are occurring, then this would indicate the IP•Tube's transmit clock is running slower than the remote tube is clocking reception of data on its port interface.

In either case of port interface Transmit UN errors or Transmit Drain Drops, check the clocking configuration on both IP•Tubes. One IP•Tube E1/T1 Clocking should be Internal or Network and the other should be V2PLL.

Improper configuration of the T1/E1 clocking will result in an overrun or underrun condition which causes T1/E1 periodic frame losses. One of the IP•Tubes must be the master clock source or locked onto a master and the remote end unit uses a Phase Lock Loop circuit to match the master's T1 clock frequency. In the case where an IP•Tube is being connected to a T1 line from the Telephone company, the IP•Tube connected to the Telco T1 line must be set to T1 Clocking Network and the remote unit set to T1 Clocking V2PLL.

Packets Out Of Sequence indicates an expected packet did not arrive at the Ethernet Interface. Usually this indicates a problem with the Ethernet interface of the local or remote tube, or a problem with the IP network.

## TCP/IP Connection

An IP Ping program is the best tool for troubleshooting TCP/IP connectivity. As a sanity check, first ensure you can ping the local router. If unsuccessful, go back to "Can’t Communicate with the Local IP•Tube" section.

## Can't IP Ping Remote IP•Tube

Cause: Ping workstation does not have Default Gateway, (or Router), set. In the workstation's IP configuration, alongside workstation's own IP address and subnet mask, you must provide the IP address of the device, (a router), to which all packets destined off the local net should be sent.

Cause: default router on the net, serving as Default Gateway for all net workstations, does not know about the remote IP net where the remote IP•Tube is located.

## SSHD Not Working

If an SSH client cannot make a connection to the IP•Tube, check the following items.

Do not enter a pass phrase to create the host key.

Be sure to use the host key without the '.pub' extension.

Make sure the SSHD is configured ON.

Check that the SSHD Port number is the same as the Client attempting the connection.

Look at the "Show SSHD Info" status. Check if SSHD is On, or there is already a session active (only one allowed), or the host key is not valid.

Use the Client logging facilities to gather information about the failed connection attempt. For the OpenSSH client, use the -vvv option. For the SecureCRT client, select the Raw Log Options from the File menu.

# Troubleshooting Tools

A good place to start is to make sure that the configurations of both IP•Tubes match except the following three items:

- LAN IP Addresses (each should be unique)
- Tube Destination Addresses (should point to the other units LAN Address)
- T1/E1 Clocking Setting (one set for Internal or Network and the other to V2PLL)

Make sure the IP•Tubes can ping one another.

## Information

Here is a sample of the Show Information command for a LAN interface. Important information points are discussed below.

```
IP Tube # sh lan1 info
Interface:              LAN1
Port Type:              Twisted-Pair
Protocol Type:          Ethernet
Speed (in Mbps):        100
Duplex Mode:            Full
Port State:             Up
Connection State:       Connected
IP State:               RUNNING
DDNS Status:            Off
Free Buffer Count:      288
```

| LAN Info Data | Description |
|---|---|
| Speed (in Mbps) | This will report the actual data speed that the Ethernet interface is communicating at regardless of the configuration.<br><br>If the LAN interface is manually configured for 100Mbps and is reporting 10Mbps, then the port is running at 10Mbps not 100Mbps.<br><br>If the interface is not reporting the correct data, check the network equipment it is connected to and make sure it is operating correctly. |
| Duplex Mode | Reports current Duplex mode<br><br>If the interface is not reporting the correct data, check the network equipment it is connected to and make sure it is operating correctly. |

Here is a sample of the Show Information command for the TEL interface. Important information points are discussed below.

```
IP Tube # sh s1 info
Interface:            S1
Port Type:            E1
Line Interface:       120Ohm
Protocol Type:        IPTube
Port State:           Up
Connection State:     Connected
Free Buffer Count:    101
```

| TEL Info Data | Description |
|---|---|
| Connection State | Informs if the proper T1 or E1 framing is present. It will report Not Connected if it does not see the correct framing it is expecting.<br><br>For T1 Framing ESF or D4<br>For E1 Framing CRC4 or FAS<br><br>When in the Connected state, the LNK LED on the corresponding TEL port will light up.<br><br>E1 cables must be balanced.<br><br>When connecting to a T1/E1 interface of T1/E1 equipment a T1/E1 cross over cable is required. There is one yellow T1/E1 cross over cable sent per port with the IP Tube. For E1 connections the cross over cable is used between the RJ45 connector on the IP Tube and the RJ45 to DB15 Male adapter, also provided with the shipment.<br><br>When connecting to a T1/E1 line use a standard RJ45 cable (8 straight 1 to 1).<br><br>An easy way to test the port is to insert a RJ45 loop back plug (Pin1 to Pin4 and Pin2 to Pin5) into the port. Then check that the TEL port's Tube Framing is set for Transparent if it is not, change it for the test. This test should result in the port showing Connected status and light the LNK LED.<br><br>The IP Tube will not transmit any data if the LNK LED is off. |

## Statistics

Here is a sample of the Show Statistics command of a LAN port. This is an error log that count the errors that occur on the interface. The data will keep until the unit is power cycled or a Clear All command is issued to clear the statistics log. A description of the errors are below with an explanation of why they may be occurring.

```
IP Tube # sh lan1 stat
Interface                        Errors:
|       Packets Received       42792396        Receive CRC           0
|                                  Receive Overrun       0
|                                  Receive Framing       0
|                                  Receive Misc          0
| LAN1  Packets Transmitted     42797045        Transmit CSL          0
|                                  Transmit UN           0
|                                  Transmit RL           0
|                                  Transmit LC           0
|                                  Transmit Misc         0
|_______                           Errors: TOTAL              0

|
|       Transmit Buffer Queue Depth:          0
```

| LAN Statistic Data | Description |
|---|---|
| Packets Received | The number of LAN packets received.<br><br>Received and Transmitted packets should be about the same. If they are not the same the packets are not getting to the IP Tube. Check network configurations, stability and bandwidth. |
| Receive CRC | The packet had a CRC error. |
| Receive Overrun | Overrun of internal FIFO used in transfer of LAN data to memory, or a frame was received and discarded due to lack of buffers, or a large frame was received. |
| Receive Framing | A nonoctect aligned frame was received |
| Receive Misc | A short frame was received, or a general error indicating an unexpected result in a buffer descriptor, or a buffer that was not a complete frame was received on the Ethernet channel. |
| Packets Transmitted | The number of LAN packets transmitted. |
| Transmit CSL | Carrier Sense Lost during frame transmission |
| Transmit UN | Transmit Underrun, The Ethernet controller encountered a transmitter underrun while sending a buffer. |
| Transmit RL | Transmit Retransmission Limit, The transmitter failed attempts to successfully send a message due to repeated collisions (statistic not set on IP•Tube). |
| Transmit LC | Late Collision, A collision occurred after 64 bytes are sent (statistic not set on IP•Tube). |
| Transmit Misc | Unspecified transmit error not associated with a buffer. |
| Transmit Buf Queue Depth | Number of Packets in the Queue |

Here is a sample of the Show Statistics command of a TEL port. This is an error log that count the errors that occur on the interface. The data will keep until the unit is power cycled or a Clear All command is issued to clear the statistics log. A description of the errors are below with an explanation of why they may be occurring.

```
IP Tube # sh s1 stat
Interface                          Errors:
|       Packets Received       42797807          Receive CRC             0
|                                        Receive Overrun         0
|                                        Receive Framing         0
|                                        Receive Misc            0
| S1    Packets Transmitted     42789443          Transmit CSL            0
|                                        Transmit UN             0
|                                        Transmit RL             0
|                                        Transmit LC             0
|                                        Transmit Misc           0
|_______                                 Errors: TOTAL                   0

|
|       Packets Out Of Sequence                  1
|       Last Sequence Disruption                 5, 7
|       Packets Arriving Too Late                0
|       Packets Not Arriving                     0
|       Packets Rcvd w Bad Source IP Addr        0
|       Packets Rcvd w Bad UDP Port              0
|       Transmit Drain Drops:                    0
|       Receive  Positive Slips                  1
|       Receive  Negative Slips                  1
|       Transmit Buffer Queue Depth:             5
```

| TEL Statistic Data | Description |
|---|---|
| Packets Received | Number of serial packets received.<br><br>Received and Transmitted packets should be about the same. If they are not the same the packets are not getting to the IP Tube. Check serial cabling.<br><br>Make sure the LNK LED is on solid for the port. If it is not, see Show Information for the TEL port for more information. |
| Receive CRC | CRC error. Should not occur with Protocol IPTube. |
| Receive Overrun | Overrun of internal FIFO used in transfer of serial data to memory, or a frame was received and discarded due to lack of buffers, or a large frame was received.<br><br>Possible broadcast storm or configuration error on IP•Tube with supporting particular LAN Speed/Duplex setting. |
| Receive Framing | Set when a frame containing a number of bits not exactly divisible by eight is received.<br><br>Possible incorrect Protocol setting on IP•Tube (HDLCOIP), faulty cable or clocking configuration error on either device. |

| | |
|---|---|
| Receive Misc | Carrier Detect Loss during buffer reception.<br><br>The Protocol setting on IP•Tube could be set incorrectly (HDLCOIP). |
| Packets Transmitted | Number of serial packets transmitted.<br><br>Check to see if there are Received LAN Packets. If there are no packets received on the LAN port, there will be no packets transmitted on the TEL port. |
| Transmit CSL | CTS was lost during frame transmission.<br><br>Possible causes are: IPTube reset, OMNI reset, cable pulled or other interface electrical failure. |
| Transmit UN | Underrun, the serial controller encountered a transmitter underrun while sending a buffer, or a transmit operation failed due to lack of buffers.<br><br>Increase Tube Buffers and/or Tube FPP.<br><br>If the Ethernet interface is running without errors, then this might indicate the transmit clock on the IP•Tube is running faster than the remote tube is clocking reception of data on its port interface.<br><br>Check clocking configurations, one IP•Tube should be Internal or Network and the other to V2PLL. |
| Transmit Misc | Unspecified transmit error not associated with a buffer. |
| Packets Out Of Sequence | A packet arrived out of sequence from the LAN interface. This indicates either a missing packet or a packet received out of order. If these packets were received they are placed in proper order and not necessarily a data error.<br><br>If these are occurring, the problem may become gross when there is heavier traffic on the network.<br><br>Points to problems on the interconnect/network. The network could be dropping or reordering packets.<br><br>Could try increasing Tube Buffers and/or Tube FPP. |
| Last Sequence Disruption | Displays the sequence number of packets received adjacent to sequence number gaps. For example, if the display is “5, 7”, that means sequence number 6 was missing. Or, “5, 56”, would indicate 50 packets were missing.<br><br>Note the sequence number is modulo 255, so a display of “255, 1” would mean only the packet with sequence number 0 is missing.<br><br>Points to problems on the interconnect/network. The network could be dropping or reordering packets.<br><br>Could try increasing Tube Buffers and/or Tube FPP. |

| | |
|---|---|
| Packets Arriving Too Late | The packet arrived with a sequence number that had already been transmitted on the serial port. The IP network delayed the packet too late for transmission. This is a data error<br><br>Interconnect (network) is not processing packets in a timely manner and/or bandwidth is saturated.<br><br>This may be due to insufficient Tube Buffers. Increase Buffers to try to resolve the problem.<br><br>For testing purposes, turn Tube Buffers to 80 and Tube FPP to 56 or the maximum allowed for the unit. Use this only as a testing configuration. Most equipment can't handle more than 100ms of round trip delay. With these settings there will be:<br><br>(FPP/8)*Buffers = (56FPP/8)*80 = 560ms of one way delay<br><br>With the above setting, there will be over 1 second of delay round trip.<br><br>This test will tell you if the interconnect/network can handle the IP•Tube traffic. Clear All statistics and view error counts. Also switching to Fractional will reduce the bandwidth. This can also be useful for testing the interconnection. |
| Packets Not Arriving | A packet for a given sequence number never arrived. This is a data error.<br><br>Interconnect (network) is not processing packets in a timely manner, dropping packets and/or bandwidth is saturated.<br><br>Gaps in sequence due to Packets Arriving Too Late or Packets Not Arriving are filled with data from the next arriving packet.<br><br>It is possible that there is not enough buffering for the jitter on the network, increase Tube Buffers and/or Tube FPP. |
| Rcvd Bad Source IP Addr | Packets that are received with the correct UDP port but the IP•Tube did not have the source address match the Tube Destination address in the configuration. This packet is dropped.<br><br>Rogue device sending packets aimed at the IP•Tube UDP port number or misconfiguration of the IP•Tube. |
| Rcvd Bad UDP Port | A UDP packet received with the correct destination and source IP address did not have the UDP source and destination port number match the Tube UDPPort number in the configuration. This packet is dropped.<br><br>There could be an IP conflict with the IP•Tube or misconfiguration of the IP•Tube. |

| | |
|---|---|
| Transmit Drain Drops | This is a serial transmit queue overflow. The number of packets in the serial transmit queue exceeds the setting of Tube Buffers by 3 packets and is dropped.<br><br>Check clocking configurations and try increasing Tube Buffers and/or Tube FPP<br><br>May occur if there are duplicate packets being created in the network. Tube Overflowlimit has a default setting of 3, try increasing this to 10. |
| Receive Positive Slips | This is a data error not shown in any other error statistic. When this error occurs there is a possibility that up to two T1 or E1 frames are lost.<br><br>When the IP•Tube is set for Clocking Internal, V2PLL or PLL settings, this shows that the device attached to this serial interface is not following the clocking provided by the IP•Tube. The clock is running faster than the IP•Tube. |
| Receive Negative Slips | This is a data error not shown in any other error statistic. When this error occurs there is a possibility that up to two T1 or E1 frames are lost.<br><br>When the IP•Tube is set for Clocking Internal V2PLL or PLL settings, this shows that the device attached to this serial interface is not following the clocking provided by the IP•Tube. The clock is running slower than the IP•Tube. |
| Transmit Buf Queue Depth | The number of packets in the serial transmit queue. |

# Appendix

## IP•Tube DL/G/RS530/V.35 Specifications

### Ethernet Port

- 10/100 Base T Full/Half Ethernet

### LAN Protocol

- IP, TCP, UDP, ICMP
- Assured Delivery Protocol

### Tube Protocols

- Engage IP•Tube
- Circuit Extension Over IP
- HDLC Over IP
- SS7 Over IP

### Serial InterfacesOptional

- T1/fractionalT1 DSU/CSU
- E1/fractionalE1 DSU/CSU
- Optional RS530 DCE/DTE:  DB-25 female
- Optional V.35 DCE/DTE:  DB-25 female

### Power Supply

- External 24 Volts AC, 1Amp,  with standard AC plug. International power supplies available

### Physical

- Standard 19 inch rack mount kit available
- Dimensions:  9.0 x 7.3 x 1.63 inches
- Weight: approximately 2 lbs., excluding external power adapter

## T1 Specifications

- One to Four Port Models
- Connects directly to T1 Line or to a DS1 interface with a Crossover Cable

- Framing - ESF or D4
- Coding - B8ZS or AMI
- Supports DS0 assignments from 1 to 24
- Non-Contiguous Configuration x-y,z supported

## E1 Specifications

- One to Four Port Models
- Connects directly to E1 Line or to a DS1 interface with a Crossover Cable
- Framing - E1Framed or Transparent
- Coding - HDB3 or AMI
- Supports DS0 assignments from 1 to 24
- Not Contiguous Configuration x-y,z Supported

## DLT1/E1 and GT1/E1 Models

### Lossless Data Compression

- Detects idle and redundant data within each DS0
- Interconnect bandwidth is not consumed by silent or redundant data within the voice circuits
- Low Latency 16 to 1 Compression
- Quality of Service Support
- IP Type of Service (TOS) CLI configurable
- IANA Registered UDP Port 3175
- Configurable Silence Detection Range
- Compression settings from 8 to 1 to 56 to 1

### Echo Cancellation

- Digital Signal Processor
- Voiceband Echo Cancelling according to ITU G.165 and G.168
- Mu- and A-Law coding according to ITU G.711
- 24 channels with end echo path delay of less than 63.75 ms

## All Models

### TFTP Online Upgrade Capable (FLASH ROMs)

- IP•Tube is fully operational during upgrade

### Management

- Telnet support with Edit and Paste Template Files (See Chapter 4: *Configuration Examples)*
- Console Port for Out of Band Management
- SNMP support (MIB I, MIB II)
- Remote configuration & monitoring

## IP•Tube Dip Switch Settings-All Models

IP•Tube systems contain a four position DIP Switch which is accessible by removing the unit rear panel and sliding out the motherboard.

The default setting for all DIP switches is **OFF**.

**Switch 1**

Power cycling the unit with DIP Switch 1 **ON** forces the IP•Tube to return to Base Flash operation and deleting any download upgrades. Ensure Switch 1 is returned to the **OFF** position after clearing an upgrade so future upgrades can be performed successfully.

**Switch 2**

Applies only to IP•Tube C units - with lossless DS0 compression. Setting to **ON** will disable the compression.

Note: This must be done at each IP•Tube and a **RESTART** or power cycle executed.

**Switch 3**

Switch 3 is used during manufacturing to test the VCXO. The switch must be set to **OFF** for normal operation.

**Switch 4**

When turned **ON**, it forces the IP•Tube T1, E1, RS530 or V.35 interface into a loopback mode. This is useful for troubleshooting the Telco/Serial connection.

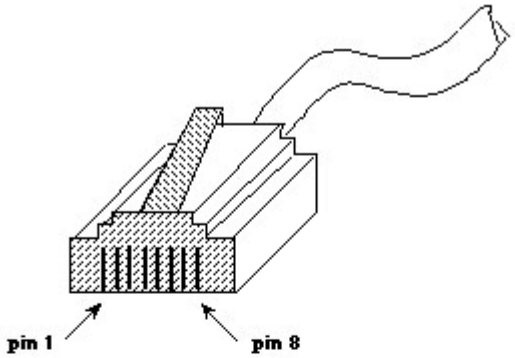
The IP•Tube UNO and G4 has a single pushbutton switch. When holding this switch durring the boot cycle it will do the following:

- Force operation from Base Flash and delete an downloaded upgrades.

On the UNO, the switch is accessable through the rear panel via a paperclip.

On the G4, the rear panel must be removed and the motherboard slid out to access the switch.

## 10/100BaseT Port Specification with Crossover cable pinout




**10BaseT Plug pin numbering**

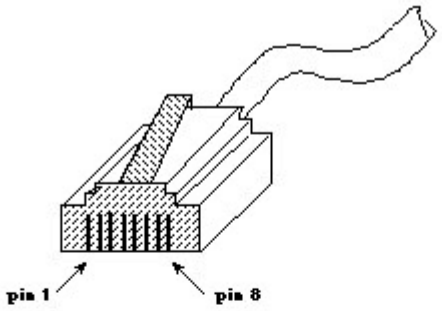
| | |
|---|---|
| Pin 1 | TxD+ |
| Pin 2 | TxD- |
| Pin 3 | RxD+ |
| Pin 6 | RxD- |

For 10BaseT Crossover (allowing connection directly between two 10BaseT devices) wire:

| | | | | |
|---|---|---|---|---|
| (TD+) | Pin 1 | to | Pin 3 | (RD+) |
| (TD-) | Pin 2 | to | Pin 6 | (RD-) |
| (RD+) | Pin 3 | to | Pin1 | (TD+) |
| (RD-) | Pin 6 | to | Pin 2 | (TD-) |

Table 5 - 10/100BaseT Port Specification

# T1 and E1 Port Specification with Crossover Pinouts




**T1/fracT1 DSU/CSU Pin numbering**

| | |
|---|---|
| 1 | R xRing |
| 2 | RxTip |
| 4 | TxRing |
| 5 | TxTip |

For T1 Crossover (allowing connection directly between two T1/fracT1 DSU/CSU devices) wire:

| | | | | |
|---|---|---|---|---|
| (TxTip) | Pin 5 | to | Pin 2 | (RxTip) |
| (TxRing) | Pin 4 | to | Pin 1 | (RxRing) |
| (RxRing) | Pin 1 | to | Pin4 | (TxRing) |
| (RxTip) | Pin 2 | to | Pin 5 | (TxTip) |

Table 6 - DSU/CSU Port Specification

## E1 RJ45 to db15 Cable

| Signal | RJ45 | db15 Male |
|---|---|---|
| TxD Tip | 5 | 1 |
| RxD Tip | 2 | 3 |
| TxD Ring | 4 | 9 |
| RxD Ring | 1 | 11 |

Table 7 - DSU/CSU RJ45 to DB15 Modular Adapter Pinout

## Console Port Information

**RJ45 Console Port Pinout**

| RJ45 pin | Signal Name |
|---|---|
| 3 | TxData |
| 6 | RxData |
| 1 | RTS |
| 8 | CTS |
| 4 | Gnd |
| 2 | DTR |

**RJ45/db9F Null Modem Adapter**

| RJ45 pin | db9pin |
|---|---|
| 3 | 2 |
| 6 | 3 |
| 1 | 8 |
| 4 | 5 |
| 2 | 6 |

Table 8 - Console Port Pinout

# RS-530 Port Specification

**The IP•Tube RS-530 Interface when configured as a DCE, (Data Communication Equipment) interface, provided via a DB25 female connector.**

| DB25 Pin No. | Signal Name | I/O |
|---|---|---|
| 1 | Shield | I/O |
| 2 | TD-A | I |
| 3 | RD-A | O |
| 4 | RTS-A | I |
| 5 | CTS-A | O |
| 6 | DSR-A | O |
| 7 | Gnd | I/O |
| 8 | CD-A | O |
| 9 | RC-B | O |
| 10 | CD-B | O |
| 11 | ETC-B | I |
| 12 | TC-B | O |
| 13 | CTS-B | O |
| 14 | TD-B | I |
| 15 | TC-A | O |
| 16 | RD-B | O |
| 17 | RC-A | O |
| 18 | N/C | |
| 19 | RTS-B | I |
| 20 | DTR-A | I |
| 21 | N/C | |
| 22 | DSR-B | O |
| 23 | DTR-B | I |
| 24 | ETC-A | I |
| 25 | N/C | |

Table 9 - RS530 DCE Port Specification

# RS-530 Port Specification

**The IP•Tube RS-530 Interface when configured as a DTE, (Data Terminal Equipment) interface, provided via a DB25 female connector.**

| DB25 Pin No. | Signal Name | I/O |
|---|---|---|
| 1 | Shield | I/O |
| 2 | TD-A | O |
| 3 | RD-A | I |
| 4 | RTS-A | O |
| 5 | CTS-A | I |
| 6 | DSR-A | I |
| 7 | Gnd | I/O |
| 8 | CD-A | I |
| 9 | RC-B | I |
| 10 | CD-B | I |
| 11 | ETC-B | O |
| 12 | TC-B | I |
| 13 | CTS-B | I |
| 14 | TD-B | O |
| 15 | TC-A | I |
| 16 | RD-B | I |
| 17 | RC-A | I |
| 18 | N/C | |
| 19 | RTS-B | O |
| 20 | DTR-A | O |
| 21 | N/C | |
| 22 | DSR-B | I |
| 23 | DTR-B | O |
| 24 | ETC-A | O |
| 25 | N/C | |

Table 10 - RS530 DTE Port Specification

# RS-232 Port Specification

**The IP•Tube RS-232 Interface has a DCE, (Data Communication Equipment) interface, provided via a DB25 female connector.**

| DB25 Pin No. | Signal Name | I/O |
|---|---|---|
| 1 | Shield | I/O |
| 2 | TD-A | I |
| 3 | RD-A | O |
| 4 | RTS-A | I |
| 5 | CTS-A | O |
| 6 | DSR-A | O |
| 7 | Gnd | I/O |
| 8 | CD-A | O |
| 9 | RC-B | O |
| 10 | CD-B | O |
| 11 | ETC-B | I |
| 12 | TC-B | O |
| 13 | CTS-B | O |
| 14 | TD-B | I |
| 15 | TC-A | O |
| 16 | RD-B | O |
| 17 | RC-A | O |
| 18 | N/C | |
| 19 | RTS-B | I |
| 20 | DTR-A | I |
| 21 | N/C | |
| 22 | DSR-B | O |
| 23 | DTR-B | I |
| 24 | ETC-A | I |
| 25 | N/C | |

Table 11 - RS232 Port Specification

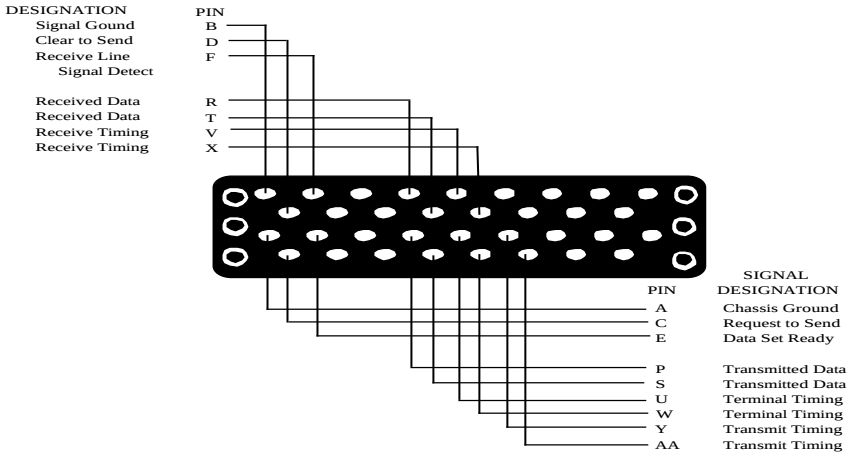
# RS-232 Port Specification

**The IP•Tube RS-232 Interface when configured as a DTE, (Data Terminal Equipment) interface, provided via a DB25 female connector.**

| DB25 Pin No. | Signal Name | I/O |
|---|---|---|
| 1 | Shield | I/O |
| 2 | TD-A | O |
| 3 | RD-A | I |
| 4 | RTS-A | O |
| 5 | CTS-A | I |
| 6 | DSR-A | I |
| 7 | Gnd | I/O |
| 8 | CD-A | I |
| 9 | RC-B | I |
| 10 | CD-B | I |
| 11 | ETC-B | O |
| 12 | TC-B | I |
| 13 | CTS-B | I |
| 14 | TD-B | O |
| 15 | TC-A | I |
| 16 | RD-B | I |
| 17 | RC-A | I |
| 18 | N/C | |
| 19 | RTS-B | O |
| 20 | DTR-A | O |
| 21 | N/C | |
| 22 | DSR-B | I |
| 23 | DTR-B | O |
| 24 | ETC-A | O |
| 25 | N/C | |

Table 12 - RS232 DTE Port Specification

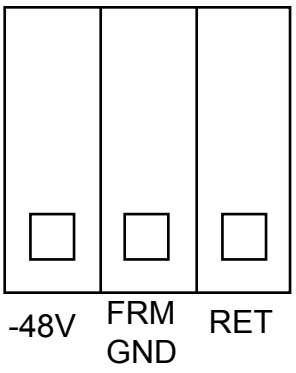
# V.35 Interface Specifications




| | |
|---|---|
| **Cable p/n:** | **091-3200** |
| **Name:** | **"V.35, db25 vers."** |
| **Connector 1:** | **db25, Male** |
| **Connector 2:** | **34 pin "M" block, male** |
| **Length:** | **3 feet** |

| | | | |
|---|---|---|---|
| **2** | **P** | **TxD A** | **<- twisted** |
| **14** | **S** | **TxD B** | **<- pair** |
| **3** | **R** | **RxD A** | **<- twisted** |
| **16** | **T** | **RxD B** | **<- pair** |
| **17** | **V** | **RxCk A** | **<- twisted** |
| **9** | **X** | **RxCk B** | **<- pair** |
| **15** | **Y** | **TxCk A** | **<- twisted** |
| **12** | **AA** | **TxCk B** | **<- pair** |
| **24** | **U** | **ExtCk A** | **<- twisted** |
| **11** | **W** | **ExtCk B** | **<- pair** |
| **6** | **E** | **DSR** | |
| **20** | **H** | **DTR** | |
| **4** | **C** | **RTS** | |
| **5** | **D** | **CTS** | |
| **8** | **F** | **RLSD** | |
| **18** | **K** | **LT** | |
| **7** | **B** | **SG** | |
| **nc** | **A** | **FG** | |

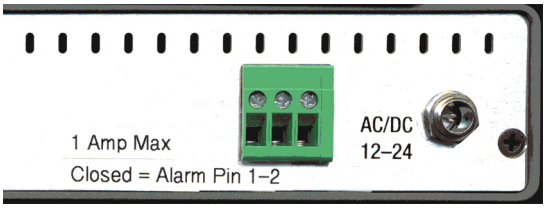
## -48V Interface Specifications




| | |
|---|---|
| -48V: | -48 Voltage |
| FRM GND: | Frame Ground |
| RET: | Return |

Table 13 - -48 Power Connector

## Alarm Relay Contact




| | |
|---|---|
| Pin 1: | Pin1 of one side of the relay |
| Pin 2: | Pin2 of the other side of the relay |
| Operation: | Pin1 will be connected to Pin2 in the event of an alarm. Maximum current for the relay is 1A. |

Table 14 - Alarm Relay Contact

**Upgrade of Engage IP•Tube, IP•Express, BlackBond and BlackDoor Systems**

**General**

This document outlines the procedure for upgrading Engage IP•Tube, IP•Express, BlackBond and BlackDoor system software.

**Procedure**

1. To determine the current system software and if running from Base or Upgrade Flash, issue the command ***show router***

2. If currently running from the Upgrade Flash the unit must be downgraded back to Base Flash before installing a new Upgrade Flash image.

    a. Issue the command ***upgrade 1 1***
    b. The unit will reboot and revert to Base Flash.
    c. This will cause a Telnet connection to drop. If this does occur, simply re-establish the Telnet connection

3. The upgrade requires a local TFTP (trivial file transfer protocol) server. Shareware TFTP servers are available online, including http://www.klever.net/kin/pumpkin/html

4. Obtain the upgrade file, and unzip password if required, from Engage Communication Technical Support (tel +1-831-688-1021 or support@engageinc.com)

5. Place the .upg file in the appropriate directory on TFTP server.

6. Ensure IP connectivity between the Engage unit and the TFTP server by pinging from one to the other. Firewall software on the TFTP server may need to be disabled to permit TFTP sessions initiated from the Engage unit.

7. Upgrade by issuing the command ***upgrade {tftp server addr} {upgrade filename}***

    *a.* Example: ***upgrade 192.168.1.1 26_72_82_upgrade.upg***

8. Notes:
    a. When the upgrade is complete, the Engage unit will reboot, causing a Telnet connection to drop. If this does occur, simply re-establish the Telnet connection.
    b. Upgrades which enable optional features (additional Ports, Compression, Protector, etc.) cause the Engage unit to revert to Base firmware. Any system software upgrades must be re-installed.



Table 15 - Engage Flash Upgrade Instructions

**Xupgrade of Engage IP•Tube, IP•Express, BlackBond and BlackDoor Systems**

**General**

This document outlines the procedure for xupgrading Engage IP•Tube, IP•Express, BlackBond and BlackDoor system hardware. This is to upgrade the system CPLD, not the system software.

**Procedure**

1. The xupgrade requires a local TFTP (trivial file transfer protocol) server. Shareware TFTP servers are available online, including http://www.klever.net/kin/pumpkin/html

2. Obtain the xupgrade file, and unzip password if required, from Engage Communication Technical Support (tel +1-831-688-1021 or support@engageinc.com)

3. Place the .xsvf file in the appropriate directory on TFTP server.

4. Ensure IP connectivity between the Engage unit and the TFTP server by pinging from one to the other. Firewall software on the TFTP server may need to be disabled to permit TFTP sessions initiated from the Engage Unit.

5. Upgrade by issuing the command ***xupgrade {tftp server addr} {upgrade filename}***

    a. Example: ***xupgrade 192.168.1.1 IPTubeGX1_BigGlue_Rev3.xsvf***

6. Note that when the xupgrade is complete, the Engage unit will reboot, causing a Telnet connection to drop. If this does occur, simply re-establish the Telnet connection.

**Engage Communication, Inc.** **Xupgrade Procedure** **page 1 of 1**

Table 16 - Engage CPLD Upgrade Instructions

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```

[Tatu continues]
```
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```

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- IDEA is no longer included, its use is deprecated
- DES is now external, in the OpenSSL library
- GMP is no longer used, and instead we call BN code from OpenSSL
- Zlib is now external, in a library
- The make-ssh-known-hosts script is no longer included
- TSS has been removed
- MD5 is now external, in the OpenSSL library
- RC4 support has been replaced with ARC4 support from OpenSSL
- Blowfish is now external, in the OpenSSL library

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```
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 *
 * Optimised ANSI C code for the Rijndael cipher (now AES)
 *
 * @author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
 * @author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
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# Glossary

## Terms and Concepts

Before using the Engage IP•Tube, you should be familiar with the terms and concepts that describe TCP/IP, Networking and T1/E1 Telecommunications.

### General Networking Terms

**Network**

A network is a collection of computers, server devices, and communication devices connected together and capable of communication with one another through a transmission medium.

**Internet**

An internet is any grouping of two or more networks connected by one or more internet routers.

**Network Services**

Network services are the capabilities that the network system delivers to users, such as print servers, file servers, and electronic mail.

**Addresses**

Transmitting information in a network system is made possible by an addressing scheme that identifies the sender and destination of the transmission, using network and node addresses. Data is transmitted to and from these addresses in the form of packets.

**Routing Table**

A routing table is maintained in each router. This table lists all networks and routers in the internet and enables routers to determine the most efficient route for each packet. The routing table serves as a logical map of the internet, specifying the address of the next router in the path to a given destination network and the distance in hops. The router uses the routing table to determine where and whether to forward a packet.

Each router periodically broadcasts its routing table to other routers on each of its directly connected networks, enabling them to compare and update their own tables with the most recent record of connected networks and routes. In this way, routing tables are kept current as changes are made on the internet.

**Hop**

A hop is a unit count between networks on the internet. A hop signifies “one router away.”

**Node**

Device on the network

# TCP/IP Networking Terms

**FTP**

File Transfer Protocol gives users the ability to transfer files between IP hosts. It uses TCP to provide connection initiation and reliable data transfer.

**Host**

A computer with one or more uses that can act as an endpoint of communication if it has TCP/IP.

**ICMP**

Internet Control Message Protocol provides a means for intermediate gateways and hosts to communicate. There are several types of ICMP messages and they are used for several purposes including IP flow control, routing table correction and host availability.

**IP**

Internet Protocol which routes the data.

**IP Datagram**

The basic unit of the information passed across and IP Internet. It contains address information and data.

**PING**

Packet InterNet Groper is a program which uses **ICMP** echo request message to check if the specifies IP address is accessible from the current host.

**Port**

A Destination point used by transport level protocols to distinguish among multiple destinations within a given host computer.

**SubNet Address**

An extension of the **IP** addressing scheme which enables an **IP** site to use a single **IP** address for multiple physical networks. Subnetting is applicable when a network grows beyond the number of hosts allowed for the **IP** address class of the site.

**TCP**

Transmission Control Protocol ensures reliable, sequential, delivery of data. **TCP** at each end of the connection ensures that the data is delivered to the application accurately, sequential, completely and free of duplicates. The application passes a stream of bytes to **TCP** which breaks it into pieces, adds a header, forming a segment, and then passes each segment to **IP** for transmission.

**Telnet**

The **TCP/IP** standard protocol for remote terminal connection service. A user can **telnet** from the local host to a host at a remote site.

**UDP**

User Datagram Protocol provides simple, efficient protocol which is connectionless and thus unreliable. The **IP** address contained in the **UDP** header is used to direct the datagram to a specific destination host.

**Well-Known Port**

Any set of port numbers reserved  for specific uses vy transport level protocols (**TCP** & **UDP**). Well-known ports exist for echo servers, time servers, **telnet** and **FTP** servers.

## Communication Link Definitions

**Synchronous Serial Interfaces**

A serial interface between two devices which provides for bi-directional data transfer as well as clocking. One device, the **DCE**, provides the transmit and the receive timing to the second device, the **DTE**.

**Data Communication Equipment (DCE)**

This interfaces to the communication service's transmission/reception medium, and includes T1 Voice/Data Multiplexors, 64/56 Kilobit DSU/CSUs, and Fiber Optic Modems. The **DCE** provides the transmit and receive data pathways, along with their synchronous clocking signals, that are used by a router's **DTE** interface for full duplex communication between the remotely interconnected networks.

**Data Terminal Equipment (DTE)**

This equipment attaches to the terminal side of **Data Communication Equipment**.

**Data Carrier Detect (DCD)**

A signal that indicates to the **DTE** that the **DCE** is receiving a signal from a remote **DCE**.

**Data Terminal Ready (DTR)**

Prepares the **DCE** to be connected to the phone line, then the connection can be established by dialing. Enables the **DCE** to answer an incoming call on a switched line.

## Other Terms

**TCXO**

Temperature Controled Oscillator

**OCXO**

Oven Controlled Oscillator